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REGULATION FOR TANK VESSELS ENGAGED IN THE CARRIAGE OF OIL IN D--ETC(U)

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DEPARTMENT OF TRANSPORTATION

COAST GUARD

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FINAL

ENVIRONMENTAL IMPACT STATEMENT

REGULATIONS FOR TANK VESSELS ENGAGED IN THE CARRIAGE OF OIL IN DOMESTIC TRADE

PROTECTION OF THE MARINE ENVIRONMENT

no others in file

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16. Abstract

This statement assess the environmental impact of proposed changes to the pollution regulations in Title 33,Code of Federal Regulations, by adding regulations governing the design and operation of certain seagoing U.S. tankships and barges certificated to carry oil in the U.S. domestic trade. The new regulations require segregated ballast on new tankships over 70,000 deadweight tons, and contain requirements for cargo tank size limits and improved tank vessel subdivision and stability. The regulations also set stringent discharge standards for both new and existing tank vessels, requiring the practice of load-on-top or retention-on-board methods to curtail discharges of oil and oily mixtures to the marine environment.

Information on economic and safety impacts of the regulations are presented, and reasons for making U.S. regulations consistent with requirements contained in the International Convention for the Prevention of Pollution from ships, 1973, are discussed. Various alternative measures are discussed, including extending segregated ballast requirements to smaller vessels and existing vessels, requiring double bottoms or double sides, and various measures to improve vessel maneuvering and stopping ability. Information on sources of pollution from tank vessels, including routine operations and vessel accidents, is presented in text and appendicies. Results of a study of various alternatives for distribution of required segregated ballast to provide protective spaces against collision or grounding damage are included in Appendix C.

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SUMMARY

( ) Draft (X) Final

Department of Transportation
U. S. Coast Guard

Contact Individual:

Executive Secretary
Marine Safety Council
U. S. Coast Guard (G-CMC/82)
Washington, D. C. 20590
(202) 426-1477

1. Name of Action.

(X) Administrative Action ( ) Legislative Action

2. Description of Action.

The pollution regulations in Subchapter O of Title 33, Code of Federal Regulations, are to be amended by adding regulations governing the design and operation of certain seagoing U. S. tankships and barges certificated to carry oil in the United States domestic trade. These regulations represent one step by the Coast Guard to implement the Ports and Waterways Safety Act of 1972 (P. L. 92-340), Title II, as amended. They are based on standards adopted by the International Conference for the Prevention of Pollution from Ships, 1973, but also include constraints on the location of segregated ballast spaces required on new tankers over 70,000 deadweight tons (DWT).

3. Environmental Impact and Adverse Environmental Effects.

The discharge criteria (along with the construction features, equipment, and operating practices necessary to meet the discharge criteria) specified in these regulations will result in a substantial reduction in the amount of oil introduced to the sea from U. S. seagoing tank vessels in domestic trade. The estimated annual oil input to the ocean from U. S. tankers in domestic trade (currently about 100,000 metric tons) will be reduced by about 80 percent as a result of these requirements with additional reductions resulting in future years as new vessels built with improved damage resistance and defensive space arrangement enter service. A much greater reduction will result from adoption of similar control measures by other countries with the adoption and entry into force of the 1973 Marine Pollution Convention. The Coast Guard hopes that extension of these standards during 1976 to U. S. vessels in foreign trade and foreign vessels entering U. S. waters will contribute toward adoption of the Convention by other countries.

It is impossible to say what impact the elimination of the oil pollution that would otherwise occur will have on the marine environment. Too little is known about the ocean system and its ability to accommodate petroleum hydrocarbon inputs. Until basic questions concerning the level of petroleum hydrocarbon input at which irreversible damage will occur can be answered it seems wisest to work for international control of inputs and push forward research to reduce our current level of uncertainty. These regulations are consistent with that goal.

These regulations should have no adverse environmental effects.

4. Economic Impact

These regulations require a number of actions to be taken by shipowners in an effort to reduce oil inputs to the oceans. These actions will require additional capital investment in vessels and equipment and will also increase operating costs. It is likely that these additional costs of doing business will be passed on to the consumer as increased transportation costs added onto the price of petroleum products. Under the most pessimistic set of assumptions, these increased transportation costs are estimated to be less than 0.2 cents per gallon. The Coast Guard has considered these costs, along with the need for regulations and the extent to which the rules being considered will contribute to safety and protection of the marine environment, and has concluded that the expenditures involved are warranted by the results expected.

5. Alternatives Considered

a. Publish no additional regulations. (No Action)

b. Publish regulation less stringent than those proposed.

c. Publish regulations more stringent than those proposed, including double bottoms, additional segregated ballast requirements, and equipment intended to improve maneuvering and stopping ability.

d. Reduction of oil consumption or reduction of oil imports.

e. Use of a different mode of transportation for oil.

6. Comments on the draft statement were requested from the following (* indicates comments were received and are attached):

Department of the Interior
*Environmental Protection Agency
*Department of Defense
*Department of Commerce
*Department of Transportation
Department of State
Sierra Club
Connecticut Citizens Action Group
*Center for Law and Social Policy (representing a number of groups)
*American Petroleum Institute
*American Institute of Merchant Shipping
American Association of Port Authorities
American Maritime Association
American Waterways Operators, Inc.
Shipbuilders Council of America
Environmental Policy Center
Coalition Against Oil Pollution
*National Audubon Society

In addition, comments were received from the State of New Jersey, Department of Environmental Protection.

7. Dates statements were made available to the Council on Environmental Quality and the public:

Draft statement 28 June 1974

Final statement 15 AUG 1975

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1. INTRODUCTION

This statement is the U. S. Coast Guard's final Environmental Impact Statement (EIS) issued in compliance with the requirements of the National Environmental Policy Act (NEPA) of 1969, section 102(2)(C) and the Guidelines of the Council on Environmental Quality (CEQ) implementing that Act, on a regulatory proposal for additional pollution regulations, Subchapter O of Title 33, directed at seagoing U. S. tank vessels engaging in domestic trade.

This statement has been extensively revised in format and has had additional information incorporated in response to comments received on the draft EIS made available to CEQ and the public on June 28, 1974. It also reflects comments made on the regulatory proposal itself, even though such comments were not directed at the contents of the draft statement. The reorganization and additions to the draft EIS were desirable to enhance readability and understanding of the proposed action. The draft EIS was not intended to be a complete "technology assessment" of the transport of oil at sea, but rather to be specifically responsive to the action as proposed and alternatives to that action. The proposed regulations are not a complete and comprehensive answer to all the complex problems arising from the transport of oil by ship. They are one step in a continuing process.

The statement has been expanded to include information which will permit the reader to more fully appreciate the scope and complexity of the tank vessel pollution problem. It also touches upon the present and projected studies necessary to support additional regulatory proposals concerned with aspects of the problem which have been identified but which are not considered within the scope of this action.

2. DESCRIPTION AND PURPOSE OF THE ACTION

2.1 Purpose

The purpose of this regulatory action is to effect a significant reduction in operational pollution from all seagoing U. S. tank vessels engaged in domestic trade, and to provide added protection against outflow in the case of accidents to new tank vessels in this trade. This will be accomplished by imposing additional requirements governing the design, construction, alteration, repair, and operation of these vessels, including the retrofitting of certain equipment and construction features to existing vessels. These regulations represent one step in the implementation of Title II of the Ports and Waterways Safety Act of 1972. Additional steps to be taken are outlined in Section 4.6 on page 82.

2.2 Background

Section 201 of the Ports and Waterways Safety Act of 1972 (P.L. 92-340, 86 Stat. 427) amended Section 4417a of the Revised Statutes of the United States (46 U.S.C. 391a) to address requirements for rules and regulations for the protection of the marine environment in addition to personnel and vessel safety.

As an initial step in implementing the Ports and Waterways Safety Act, the Coast Guard published in the January 26, 1973, issue of the Federal Register (38 FR 2467), an advance notice of proposed rulemaking that invited comments from the public concerning standards for pollution abatement for new tankships constructed for trade on the navigable waters of the United States. The construction requirements concerned segregated ballast tanks, achieved in part by fitting in the cargo length a double bottom.

The advance notice was published with two purposes in mind:

1. Implementation of Section 201 of the Ports and Waterways Safety Act of 1972 (P.L. 92-340, 86 Stat. 427, 46 U.S.C. 391a(7)) to comply with the effective date mandated by Congress. This was especially important in view of the long lead time the marine industry needs for orderly planning and design engineering; and

2. Solicitation of comments from all sectors of the public. Sixty-seven written comments were received on the proposal and an evaluation of the comments was made. The comments involved much more than simple expressions of support or nonsupport. Three common areas of concern appeared with a fair degree of commonality in the comments. These were:

    a. The high initial cost associated with double bottoms.

    b. The need for international agreement and the danger of unilateral action.

c. The treatment to be accorded existing foreign and domestic shipping not covered by the proposal.

In the July 5, 1973, issue of the Federal Register (38 FR 17848), the Coast Guard published a supplement to the advance notice of proposed rulemaking. This supplement explained that 46 U.S.C. 391a(7)(C), as amended, allows for the establishment of rules and regulations consonant with international treaties, conventions, or agreements. Since the International Conference on Marine Pollution was scheduled for October 1973 and since the results of the conference would have a direct bearing on implementing regulations under Section 391a(7), the Coast Guard notified the public that action under the advance notice would be withheld until after the Conference.

Pollution of the seas by oil as a result of vessel operations has been recognized as a world problem for some years, and pollution prevention measures have been the subject of several international agreements (for example, the International Convention for the Prevention of Pollution of the Sea by Oil, 1954, along with 1962 and 1969 amendments to that agreement). The main purpose of the international conference held in London, England, during October 1973, at which some 79 countries were represented, was for nations to agree on further measures to reduce oil pollution from tank vessels. Considerable work went into preparation for the Conference, and, on the basis of studies done in this country, the U. S. position prior to the Conference included a provision that segregated ballast, carried in part in double bottoms, should be required on vessels larger than 20,000 DWT. In spite of the U. S. delegation's efforts, this position received only token support at the Conference. The resulting International Convention for the Prevention of Pollution from Ships, 1973, (referred to in this statement as "the 1973 Marine Pollution Convention" or "the Convention") requires segregated ballast for ships over 70,000 DWT but no double bottoms. While this was considerably less than the U. S. had hoped to achieve, it is a great improvement over the requirements currently in effect for tankers. The 1973 Convention far surpasses, in both breadth of coverage and in methods of control, previous international agreements. For example, the discharge of light refined oil products will be controlled for the first time as will a number of other previously unregulated major sources of marine pollution. The carriage of noxious liquid substances will be regulated and requirements on discharges will be imposed ranging from retention on board for disposal at shoreside reception facilities to dilution of the residue prior to discharge. In a number of respects the 1973 Marine Pollution Convention represents a significant step forward in international efforts to control marine pollution.

About the same time the Conference was ending in London, on November 16, 1973, there was a change in dates by which regulations were to be effective. Rules published pursuant to 46 U.S.C. 391a(7)(c) were now to be effective by June 30, 1974, for U. S. flag vessels engaged in coastwise trade, as a result of Section 401 of the Act of November 16, 1973 (P. L. 93-153, 87 Stat. 589).

After the Conference, the Coast Guard was faced with making a number of significant policy decisions before drafting proposed regulations. Answers to the following questions were sought:

. Should the U. S. accept the standards agreed upon internationally or take unilateral action to impose higher standards on U. S. ships and foreign ships entering U. S. waters?

. If we accept the Convention results for foreign ships and U. S. ships in foreign trade, need there be different standards applied to U. S. ships in domestic trade?

The following policy alternatives were available:

1. Adopt the Convention standards for all U. S. vessels and all foreign vessels entering U. S. waters.

2. Require higher standards for U. S. vessels in domestic trade.

3. Require higher standards for all U. S. vessels.

4. Require higher standards for all U. S. vessels and all other vessels entering U. S. ports.

Factors considered in selecting one of these policy alternatives included not only environmental considerations but also social, legal, economic, political, and safety factors.

Faced with a revised deadline of June 30, 1974, to have regulations for U. S. vessels engaged in coastwise trade effective, the Coast Guard considered the situation and the information available and concluded:

. The 1973 Marine Pollution Convention, while not containing everything the United States would have liked, did offer potential for significant reduction in oil inputs to the world's oceans,

. This reduction was a needed step and in the Coast Guard's judgement, provided an adequate level of abatement of operational pollution, at least for the immediate future, and

. Regulations issued by the Coast Guard for domestic tankers should be consistent with the Convention with the view toward fully implementing the Convention for all U. S. tankers and foreign tankers entering our ports by the 1976 deadline specified in the Ports and Waterways Safety Act. (A policy, in effect, of implementing the Convention early, before it came into effect as international law.)[1]

So proposed regulations were developed and, after consultation with the Environmental Protection Agency, the Maritime Administration, and others, were published in the June 28, 1974, issue of the Federal Register.

Public hearings were held on July 23 and 24, 1974, in Seattle, Washington, and on July 30 and 31, 1974, in Washington, D. C. Ninety-eight written comments were also received, which were added to the comments on the advance notice received earlier.

Since the deadline for receipt of public comments in August 1974, the Coast Guard has been involved in analysis of those comments and in various studies and discussions to try to accommodate objections to the proposed rules expressed by members of Congress, environmental groups, and government agencies. The study of segregated ballast location discussed on page 19 and in Appendix C, page 241 and the resulting modification to the rules to specify distribution of segregated ballast spaces is one such effort. During this period the grounds for the Coast Guard conclusions stated above have also been thoroughly reviewed. The draft environmental impact statement has been revised to reflect the comments, studies, discussions, and review of decisions made earlier before the proposed rules were published.

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[1]Factors considered in reaching these conclusions and reasons behind them are discussed on pages 6-10.

The Coast Guard remains convinced that U. S. participation and leadership in international pollution control efforts is absolutely essential and that the approach taken in the proposed rules published June 28, 1974, was correct, even if poorly explained in the draft environmental impact statement. The final rules are, therefore, essentially the same as the proposed rules, except that requirements for distribution of segregated ballast spaces have been added to make maximum effective use of such spaces to reduce oil outflow resulting from collisions and groundings.

In developing these regulations the Coast Guard has followed the procedure outlined in Title II of the Ports and Waterways Safety Act by considering:

1. The need for regulations.

2. The extent to which proposed regulations will contribute to safety or protection of the marine environment.

3. The practicability of compliance with the regulations including cost and technical feasibility.

The need for regulations, in terms of oil inputs to the marine environment and their effects, are discussed in Section 3, starting on page 23. The contributions the regulations will make toward reduction of oil inputs and the practicability of compliance with the rules are also discussed in Section 3. In view of the information developed and presented in Section 3, the Coast Guard has concluded:

. Current levels of oil input to the marine environment are not causing serious irreversible damage, but no one is really sure how much oil the oceans can accommodate--it may be many times the current inputs or within an order of magnitude of current levels (ten times larger).

. Tank cleaning and ballasting of tankers are responsible for approximately 80 percent of the oil entering the oceans from tankers and about 18 percent of the estimated worldwide input of petroleum hydrocarbons. They thus constitute the most serious threat to the marine environment due to pollution from oil tankers.

. Because of tanker ownership and trade patterns and the international nature of world shipping, international control of oil inputs from tank cleaning and ballasting of tankers is absolutely essential.

. The 1973 Marine Pollution Convention, while not achieving all that the Coast Guard would have liked, particularly in the area of accidental protection, offers the potential for effectively controlling oil inputs from tanker operations and reducing them to acceptable levels.

. The Convention deserves wholehearted U. S. support and should serve as the basis for regulations for U. S. tankers and foreign tankers entering U. S. waters issued under the Ports and Waterways Safety Act of 1972.

The Coast Guard feels there are a number of good reasons why the United States should accept the provisions of the 1973 Marine Pollution Convention as a sound basis for regulatory action.

One reason is because of its effectiveness in reducing oil entering the oceans. Implementation of the Convention provisions will significantly reduce operational discharges from vessels and will also affect accidental discharges to some extent (through application of tank size, subdivision, and stability requirements). Specific details of these requirements and their effects are discussed later in this Section and in Section 3. Due to the international nature of ocean shipping and the realities of world petroleum trade, the United States, working alone, cannot make a significant impact on operational pollution -- it must be a cooperative international effort.

Congress has taken specific notice of the need for international cooperation in circumstances involving worldwide environmental problems. Section 102(2)(E) of the National Environmental Policy Act directs that:

> "to the fullest extent possible: . . . all agencies of the Federal Government shall -- . . . recognize the worldwide and long-range character of environmental problems and, where consistent with the foreign policy of the United States, lend appropriate support to initiatives, resolutions, and programs designed to maximize international cooperation in anticipating and preventing a decline in the quality of mankind's world environment; . . ."

The wisdom of this provision pertains even where the results achieved from international cooperation are less than completely satisfactory. The important point is that where substantial improvement has been made through this cooperative process -- as was achieved at the 1973 Marine Pollution Conference -- the process should be supported.

There are also economic and political reasons for ratifying the Convention and implementing it in U. S. regulations. Complications arising out of unilateral action, including loss of foreign trade, retaliatory actions against U. S. shipping, and adverse effects on foreign relations, are all avoided by making our actions consistent with an already agreed-upon international course of action.

There are some additional reasons for Coast Guard optimism concerning effectiveness of the 1973 Marine Pollution Convention. The Convention contains two extremely important provisions whose significance is not widely appreciated. One of these provisions will make it much easier to bring this Convention into force than it has been to make previous international pollution prevention agreements international law. The second provision will make future amendment of the Convention's technical provisions and regulations much faster. To illustrate, the 1969 amendments to the 1954 Pollution Prevention Convention have not become international law due to the large number of nations whose ratifications are needed to bring them into force. The 1973 Convention, however, will be brought into force 12 months after ratification by only 15 nations who, between them, control 50 percent of the gross tonnage in the world's merchant fleet. This formula offers the possibility for rapid entry of the Convention into force compared to past agreements. In addition, the 1973 Convention can be amended through a tacit acceptance procedure initiated at regular meetings of permanent IMCO bodies. A special conference is not required as in the past. So it will be possible in the future to change the agreement more quickly, making it much more responsive to environmental and technological developments. Both of these features are significant steps forward in international efforts to control marine pollution.[2]

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[2]For additional background and discussion on the 1973 Marine Pollution Convnetion see references 1, 2, and 3.

All of this may explain why the Coast Guard feels it is important for the United States to ratify the 1973 Marine Pollution Convention and even to use the Convention as the basis for regulations for U. S. tankers in foreign trade and foreign tankers entering U. S. waters. But why does the Coast Guard feel it is necessary to make regulations for seagoing U. S. tank vessels in domestic trade the same as the regulations for vessels engaged in foreign trade?

A number of comments critical of the Coast Guard's decision on this point were received on both the draft environmental impact statement and the proposed regulations. Basically, the commenters wanted higher construction standards (double bottoms in particular) for U. S. tank vessels engaged in domestic trade and could not see why the Coast Guard had not imposed such standards.

The Coast Guard feels any distinctions or differences in the regulations it issues under the Administrative Procedure Act should be based on categories or distinctions established by law, or on some safety or environmental reason for distinguishing among members of a group. In the Coast Guard's opinion neither of these conditions exists at present with respect to the measures being considered, and there is therefore no legal basis for issuing rules for U. S. tank vessels engaged in domestic trade which are different from those to be made applicable to other U. S. tank vessels and to foreign vessels entering U. S. ports.

Prior to its amendment by the Ports and Waterways Safety Act of 1972, the Tank Vessel Act (46 U.S.C. 391a) required the Commandant of the Coast Guard to establish rules and regulations to secure effective provision against the hazards to life and property created by the operation of U. S. tank vessels. The resulting regulations made no distinction between tank vessels in domestic trade and those in foreign trade. There were, however, distinctions among various classes of tank vessels based on safety reasons. These distinctions in the requirements were based on factors related to the risks associated with operation of the vessel (e.g., vessel size, exposure to rough weather, or dangerous characteristics of the cargo).

In July 1972, the Ports and Waterways Safety Act amended the Tank Vessel Act, directing that increased awareness be paid to environmental protection features of tank vessel design, construction, alteration, maintenance, and operation. The Ports and Waterways Safety Act did not establish that any distinction should be made among U. S. tank vessels on the basis of trade route. Section 201(7)(D) of the Act did state that rules must be equally applicable to U. S. vessels in foreign trade and foreign vessels trading into the United States.

If no distinction is created by law, how about a distinction on the basis of safety or environmental reasons? One comment argued that there was a basis for such distinction:

"There is an environmental justification for applying standards to coastal traffic. Coastal tankers will tend to spend more time in ecologically sensitive waters. Thus ballasting operations may seriously damage the environment, even if low effluent levels can be achieved. Moreover, the risks of groundings and collisions are especially high for smaller coastal tankers which often enter into narrow, shallow, and crowded harbors. Special attention must necessarily be given to their maneuverability characteristics and to means to prevent or reduce outflow should accidents occur. Under such circumstances, it is manifestly unsound, from an environmental perspective, to consider that uniform standards must be applied to <u>all</u> tank vessels trading in U. S. navigable waters.[3]"

One problem with this argument is that "coastal traffic" is not equivalent to "domestic trade." Reference to a map of North America indicates the "domestic trade" routes from Gulf ports to the east coast of the United States traverse much the same waters as "coastal traffic" between Caribbean or Canadian ports and U. S. east coast ports. This is one major pitfall of domestic trade--foreign trade distinctions in safety and environmental protection regulations. As far as tanker operations are concerned, the discharge criteria in the regulations prohibit any discharge of oily mixtures within 50 miles of land, so ballasting operations will not seriously damage the environment in "these ecologically sensitive waters" as the comment alleges. With respect to tanker accidents, the Coast Guard has expended considerable effort in developing methods to assess the risks associated with various forms of marine transportation in order to improve regulation making efforts and to put them on a more rational basis. Risk assessment is a particularly difficult task. While intuition might lead one to conclude "the risks of groundings and collisions are especially high for smaller coastal tankers which often enter into narrow, shallow and crowded harbors," the Coast Guard has not yet been able to factually support such a conclusion, nor, to our knowledge, has anyone else.

In summary, the Coast Guard does not feel an adequate case for making a distinction in the regulations between U. S. tankers in domestic trade and U. S. tankers in foreign trade on the basis of safety or environmental grounds has been established. Lacking such a basis for distinction in the regulations, or some distinction created by law, the Coast Guard feels it is legally obligated to apply the same rules to both groups of vessels.

Existing Coast Guard vessel inspection regulations use the terms "coastwise" and "coastwise routes" in a different sense than did Public Law 93-153 in moving up the date of the regulations for U. S. flag vessels engaged in coastwise trade. To avoid confusion arising out of these differing usages, the term "domestic trade" is used in this statement and in the proposed regulations to refer to "trade between ports or places within the United States, its territories and possessions, either directly or via a foreign port including trade on the navigable rivers, lakes, and inland waters."

[3] Comments on draft EIS submitted by Center for Law and Social Policy, at page 16. (See page 133 of this final environmental impact statement.)

These regulations apply to seagoing tank vessels of 150 gross tons or more. With the exception of subdivision and stability requirements applicable to vessels operating on the Great Lakes, these regulations will not affect vessels certificated by the Coast Guard for Great Lakes, Lakes, Bays and Sounds, and River routes. A different and distinctive rulemaking under development will be made applicable to these vessels. These vessels are of relatively small size (mostly under 2,000 gross tons), routinely engage in very short voyages in waters where no discharge of oil is permitted, have little need to ballast tanks, and are often engaged in "dedicated service" which minimizes the need to clean cargo tanks. The regulatory action under consideration would not be appropriate to these vessels, hence, the need for a different rulemaking.

2.3 Description of the Regulations

These regulations apply to U. S. flag seagoing tankships and seagoing barges certificated to carry oil in domestic trade.[4] Tank vessels certificated for Great Lakes, Lakes, Bays and Sounds, and River routes are not included in this regulatory action for the reasons discussed above. The standards to be published incorporate the provisions of the Oil Pollution Act Amendments of 1973 (P. L. 93-119, 87 Stat. 424, Oct. 4, 1973).

Definitions contained in the regulations, and repeated below, include several terms which have been used in previous regulations but not carefully defined. They are defined in these regulations to avoid ambiguity.

Provision is made in the regulations for the Coast Guard to accept an equivalent (such as alternative materials, methods, procedures, etc.) of a required design or equipment feature; however, operational methods to effect the control of discharge of oil may not be substituted as equivalent to required design and equipment features.

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[4] The proposed rules, "Tank Vessels in the Domestic Trade," published in the June 28, 1974, Federal Register are reprinted in Appendix A, starting on page 228. These proposed rules are provided for reference in reading this statement. The note on page 228 summarizes the significant changes that will be incorporated in the final rules. Final rules will appear in the Federal Register about 30 days after this statement is made available to the public.

2.4 Definitions

1. "Length" or "L" means the distance in meters from the fore side of the stem to the axis of the rudder stock on a waterline at 85 percent of the least molded depth measured from the molded baseline, or 96 percent of the total length on that waterline, whichever is greater. In vessels designed with drag, the waterline is measured parallel to the designed waterline.

2. "Amidships" means the middle of the length.

3. "Breadth" or "B" means the maximum molded breadth of a vessel in meters.

4. "Center tank" means any tank inboard of a longitudinal bulkhead.

5. "Clean ballast" means the ballast in a tank which, if discharged from a vessel that is stationary into clean, calm water on a clear day, would not --

    a. Produce visible traces of oil on the surface of the water or on adjoining shorelines; or

    b. Cause a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines.

6. "Combination carrier" means a vessel designed to carry oil or solid cargoes in bulk.

7. "Deadweight" or "DWT" means the difference in metric tons between the displacement of a vessel in water of a specific gravity of 1.025 at the load waterline corresponding to the summer freeboard and the lightweight of the vessel.[5]

8. "Lightweight" means the displacement of a vessel in metric tons without cargo, oil fuel, lubricating oil, ballast water, fresh water and feed water in tanks, consumable stores, and any persons and their effects.

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[5]This is the definition for deadweight which will appear in the final rules. It is slightly different from the definition contained in the proposed rules.

9. "New vessel" means a vessel that --

a. Is constructed under a contract awarded after December 31, 1974[6];

b. In the absence of a building contract, has the keel laid or is at a similar stage of construction after June 30, 1975;

c. Is delivered after December 31, 1977; or

d. Has undergone a major conversion for which --

i. The contract is awarded after the effective date of the regulations;

ii. In the absence of a contract, conversion is begun after June 30, 1975; or

iii. Conversion is completed after December 31, 1977.

10. "Existing vessel" means any vessel that is not a new vessel.

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[6]Contract award, keel laying, and delivery dates used in this definition are identical to the dates used in the June 28, 1974, notice of proposed rulemaking. Reasons for this are discussed on page 42.

11. "Major conversion" means a conversion of an existing vessel that --

a. Substantially alters the dimensions or carrying capacity of the vessel;

b. Changes the type of the vessel;

c. The intent of which, in the opinion of the Coast Guard, is substantially to prolong the vessel's service life; or

d. Otherwise so alters the vessel or a portion of the vessel that the vessel is no longer considered by the Coast Guard to be an existing vessel.

12. "From the nearest land" means from the baseline from which the territorial sea of the United States is established in accordance with international law.

13. "Instantaneous rate of discharge of oil content" means the rate of discharge of oil in liters per hour at any instant, divided by the speed of the vessel in knots at the same instant.

14. "Oil" means petroleum in any form including oil, sludge, oil refuse, and refined products.

15. "Oil fuel" means any oil used as fuel for the propulsion and auxiliary machinery of the vessel in which it is carried.

16. "Oily mixture" means a mixture with any oil content.

17. "Permeability of a space" means the ratio of the volume within a space that is assumed to be occupied by water to the total volume of that space.

18. "Segregated ballast" means the ballast water that is introduced into a tank which is completely separated from the cargo oil and oil fuel system and which is permanently allocated to the carriage of ballast.

19. "Slop tank" means a tank specifically designated for the collection of cargo drainings, washings, and other oily mixtures.

20. "Tank" means an enclosed space that is formed by the permanent structure of a vessel, and designed for the carriage of liquid in bulk.

21. "Tank barge" means a tank vessel not equipped with a means of self-propulsion.

22. "Tank vessel" means a vessel that is specially constructed or converted to carry liquid bulk cargo in tanks and includes tankers, tankships, tank barges, and combination carriers when carrying oil cargoes in bulk.

23. "U. S. vessel" means a vessel that is owned, documented, or registered in the United States and is not a public vessel.

24. "Wing tank" means a tank that is located adjacent to the side shell plating.

25. "Tankship" means a tank vessel propelled by mechanical power or sail.

26. "Domestic trade" means trade between ports or places within the United States, its territories and possessions, either directly or via a foreign port including trade on the navigable rivers, lakes, and inland waters.

2.5 Discharge Criteria

Seagoing vessels of less than 150 gross tons must retain on board any oily mixtures or transfer them to a reception facility. (Clean ballast and segregated ballast may be discharged overboard.) Seagoing vessels of 150 gross tons or more must discharge oil mixtures overboard in accordance with the criteria outlined below, or retain the oily mixture on board, or transfer the oily mixture to a reception facility. The use of chemicals to treat an oily mixture to circumvent the discharge requirements is not allowed.

An oily mixture from a cargo tank may be discharged into the sea if a tank vessel complies with all of the following:

1. Is more than 50 nautical miles from the nearest land;

2. Is proceeding en route;

3. Is discharging at an instantaneous rate of oil content not exceeding 60 liters per nautical mile;

4. Does not discharge a total quantity of more than 1/15,000 for an existing vessel or 1/30,000 for a new vessel of the total quantity of cargo that the discharge formed a part; and

5. Has in operation the required oil discharge monitoring and control system.

An oily mixture from a machinery space bilge, except cargo pump rooms, may be discharged into the sea, unless combined with an oily cargo mixture, if the tank vessel complies with all of the following:

1. Is more than 12 nautical miles from the nearest land;

2. Is proceeding en route;

3. Is discharging an effluent with an oil content of less than 100 parts per million; and

4. Has in operation the required oil discharge monitoring and control system or the required oily water separating equipment.

Oil-water separating and filtering equipment will be required on new and existing tank vessels. These devices will be used for oily bilge water and ballast water from oil fuel tanks. All discharges of effluent from the cargo spaces of a tank vessel will be required to go through a monitoring and control system which will ensure that any oil discharge is automatically stopped when the oil content of the effluent exceeds that permitted by the discharge criteria. The monitoring and control system must be fitted with a recording device to provide a continuous permanent record of the oil content of the effluent. All of this equipment is essential in practicing the improved LOT system for shipboard handling cargo oil. The proposed regulations require such equipment; but the installation of the equipment will not be required until after the effective date of regulations publishing specifications, testing, labeling and approval procedures for the equipment. The detailed specifications of these systems and equipment are under development. (Refer to page 48 for additional discussion.)

Relief from the discharge criteria is given in those cases where safety of the vessel, saving of life at sea, or accidental damage to a vessel or its equipment is involved; except if the owner, master or person in charge acted either with intent to cause damage, or recklessly and with knowledge that damage would probably result.

New tank vessels will not be allowed to put ballast water in oil fuel tanks.

An important feature of these new rules is the changes they make in the definitions of the terms oil and oily mixture used in the regulations. Under the old definitions, based on the Oil Pollution Act of 1961 (33 U.S.C. 1001-1015), oil is limited to crude oil, fuel oil, heavy diesel oil, and lubricating oil. An oily mixture is presently defined as a mixture containing over 100 parts per million of oil. Under these definitions the discharge of so-called "non-persistent" oils (such as gasoline and other refined products) is not prohibited, even inside the 50 mile prohibited zone. The new definitions, paralleling those in the Federal Water Pollution Control Act, as amended, (P. L. 92-500) and the 1973 Marine Pollution Convention, cover petroleum in any form, including oil, sludge, and oil refuse, and in any quantity. Thus, the criteria in the new regulations are applicable to a much wider range of discharges than are those presently in force.

These regulations will change the requirements for entries in the Oil Record Book both for tank vessels and for ships other than tank vessels. On tank vessels entries must be made whenever the following operations take place:

1. Loading of oil cargo;

2. Internal transfer of oil cargo during voyage;

3. Opening or closing before and after loading and unloading operations of valves or similar devices which inter-connect cargo tanks;

4. Opening or closing of means of communication between cargo piping and seawater ballast piping;

5. Opening or closing of ships' side valves before, during and after loading and unloading operations;

6. Unloading of oil cargo;

7. Ballasting of cargo tanks;

8. Cleaning of cargo tanks;

9. Discharge of ballast except from segregated ballast tanks;

10. Discharge of water from slop tanks;

11. Disposal of residues;

12. Discharge overboard of bilge water which has accumulated in machinery spaces while in port, and the routine discharge at sea of bilge water which has accumulated in machinery spaces.

13. The discharge of oil or oily mixture from a ship for the purpose of securing the safety of the ship, preventing damage to the ship or cargo, or saving of life at sea; or,

14. The escape of oil, or of oily mixture, resulting from damage to the ship or unavoidable leakage; or,

15. Accidental or other exceptional discharges or escapes of oil from tankers or ships other than tankers.

Ships other tnan tankers will now be required to make entries in the Oil Record Book when operations 13, 14, or 15 above take place.

The discharge controls now in effect are discussed here for comparison to the new regulations. The Oil Pollution Act of 1961, as amended, established certain prohibited zones within which discharges of oil or oily mixtures with an oil content greater than one hundred parts per million (ppm) by tankers over 150 gross tons are prohibited. It also prohibits these same discharges by ships other than tankers, over 500 tons in gross tonnage, within any of the prohibited zones, except when the ship is proceeding to a port not provided with adequate facilities for the reception of these oily mixtures. Such discharges are to be made as far as practicable from land. The prohibited zones as established are defined as all areas within 50 miles from the nearest land, subject to extensions made in accordance with the terms of the 1954 Convention and published in 33 CFR 151. Ships of 20,000 gross tons or more, built after May 18, 1967, are prohibited from discharging oil or an oily mixture anywhere in the oceans except when, in the opinion of the master, special circumstances make it neither reasonable nor practicable to retain the oil or oily mixture on board. In this situation, a discharge is permitted outside of a prohibited zone. Discharges prohibited by the Convention do not apply when a discharge is made for the purpose of securing the safety of the ship, preventing damage to a ship or cargo, or saving life at sea, nor do the prohibitions apply to the escape of oil or oily mixture resulting from damage to a ship or unavoidable leakage, nor to the discharge of residue arising from the purification or clarification of fuel oil or lubricating oil provided such discharge is made as far from land as practicable. The prohibitions also do not apply to the discharges from the bilges of a ship of an oily mixture containing no oil other than lubricating oil which has drained or leaked from machinery spaces.

Regarding the present Oil Record Book requirements, this book must contain entries whenever any of the following operations takes place in the ship:

1. Ballasting of and discharge of ballast from cargo tanks of tankers;

2. Cleaning of cargo tanks of tankers;

3. Settling in slop tanks and discharge of water from tankers;

4. Disposal from tankers of oily residues from slop tanks or other sources;

5. Ballasting, or cleaning during voyage, of bunker fuel tanks of ships other than tankers;

6. Disposal from ships other than tankers of oily residues from bunker fuel tanks or other sources;

7. Accidental or other exceptional discharges or escapes of oil from tankers or ships other than tankers.

8. The discharge of oil or oily mixture from a ship for the purpose of securing the safety of the ship, preventing damage to the ship or cargo, or saving of life at sea; or,

9. The escape of oil, or of oily mixture, resulting from damage to the ship or unavoidable leakage; or,

10. The discharge of residue arising from the purification or clarification of fuel oil or lubricating oil; or,

11. The discharge of oil or oily mixtrue from a ship of 20,000 gross tons or over for which the building contract is placed on or after May 18, 1967, including a tanker.

2.6 Proposed Design Requirements

2.6.1 Segregated Ballast

A new tank vessel of 70,000 tons deadweight or more must be designed with segregated ballast tanks. The combined capacity of the segregated ballast tanks must be of sufficient size that the vessel can operate safely without recourse to the use of oil tanks for water ballast. To ensure sufficient capacity of the ballast tanks the following draft and trim design criteria are applied to the vessel:

a. The molded draft amidships (dm) in meters without taking into account any vessel deformation may not be less than:

$$dm = 2.0 + 0.02L$$

b. The trim by the stern in association with draft amidships (dm) may be no more than 0.015L.

c. The minimum allowable draft at the after perpendicular is that which is necessary to obtain full immersion of the propeller(s).

Ballast water may be carried in a cargo tank during abnormally severe weather if more ballast water than can be carried in segregated ballast tanks is required for the safety of the vessel. This ballast water must be processed and discharged in compliance with the discharge criteria and an entry recorded in the Oil Record Book.

The rules proposed June 28, 1974, have been changed to include in the final rules a requirement for distribution of segregated ballast spaces. Segregated ballast spaces must be distributed between the cargo tanks and the vessel's hull or between cargo wing tanks along the shell plating of the vessel in accordance with the criteria detailed in a new Appendix C included in the final regulations.[7] The distribution of segregated ballast capacity is not specified by the 1973 Marine Pollution Convention. Study has shown that distribution or required ballast space can be beneficial in mitigating the effects of collision or stranding accidents. The degree of effectiveness of such spaces depends on a number of factors discussed in Appendix C of this statement along with the criteria for distributing ballast spaces. Calculations verifying the vessel meets the criteria for distribution of segregated ballast spaces must be submitted to the Coast Guard for review.

2.6.2. Pumping, Piping and Discharge Arrangements

A pipeline for the discharge into the sea of an effluent that is in compliance with the discharge criteria must terminate on the open deck or on the vessel's side above the waterline in the deepest ballast condition. Existing vessels which carry some segregated ballast will not be required to modify pump room piping to enable them to discharge segregated ballast above the waterline in the deepest ballast condition. In the case of new vessels, an additional piping arrangement may be allowed by the Coast Guard to discharge segregated ballast and clean ballast below the waterline while the vessel is in port or at an offshore terminal.

The proposed regulations will require a manifold be located on the weather deck on each side of the vessel for connection to reception facilities in order to transfer dirty ballast water or oil contaminated water.

A new tank vessel must also have a designated area on the weather deck or above that is (a) located so that the pipeline terminations and the manifold referenced above may be visually observed; and (b) equipped with either a means to directly stop the discharge of effluent into the sea or a positive communication system, such as a telephone or radio, between the observation area and the discharge control position.

Further, a tank vessel must have a fixed piping system designed to allow the transfer of dirty ballast residue and tank washings from a cargo tank into a slop tank.

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[7] These criteria are described on page 241 in Appendix C, Report of Study Group on Location of Segregated Ballast, which gives details on the study which developed them and the text to be included in the final regulations.

2.6.3 Slop Tanks

New tank vessels of less than 70,000 DWT and all existing tank vessels must have at least one slop tank. A new vessel of 70,000 DWT or more must have two slop tanks. It is the Coast Guard's intention that, on an existing tank vessel, a cargo tank may be used as the required slop tank so long as the necessary piping modifications are made. A slop tank must have the capacity to retain slop from tank washings, oil residues, and dirty ballast residues, but the total capacity may not be less than three percent of the oil capacity of the vessel except two percent of the oil capacity of the vessel will be accepted if (1) there is the required amount of segregated ballast space or (2) eductors that use water in addition to the washing waters are not fitted. Each slop tank must be designed with a separate inlet and outlet. It is the Coast Guard's intention to allow slop tanks to be used to carry cargo on the loaded leg of a voyage, since they are not required for treating oily mixtures during that time.

2.6.4 Oily Residue Tank (Sludge)

A tank vessel of 400 gross tons or more must have a tank that receives and holds oily residue resulting from purification of fuel and lubricating oil and oil leakages in machinery spaces. This sludge tank must have an adequate capacity that is determined by the type of machinery installed on the vessel and the maximum fuel oil capacity. Each oily residue tank on a new tank vessel must be designed to facilitate cleaning and transfer of residue to a reception facility.

2.6.5. Cargo Tank Arrangement and Size

The Oil Pollution Act Amendments of 1973 revised the Oil Pollution Act, 1961 (75 Stat. 402, 33 U.S.C. 1001 et seq.). In Section 2(5) of the new Act, it is required that tankers built in the United States after the effective date of the section be built in compliance with Annex C of the 1971 Amendments to the International Convention for the Prevention of the Pollution of the Sea by Oil, 1954. Annex C to the 1971 Amendments is concerned with tank arrangement and maximum size. In accordance with the Act, tankers built before the effective date of Section 2(5) are required to be in compliance within two years after that date if the delivery of the tanker is after January 1, 1977, or if delivery is before January 1, 1977, and the building contract is placed after January 1, 1972, or when there is no building contract and the keel is laid or the tanker is at a similar stage of construction after June 30, 1972. The effective date of Section 2(5) is the date of enactment or the date the 1971 amendments to the 1954 Convention, as amended, are ratified or accepted with the advice and consent of the Senate of the United States, whichever is the later date. As of the date of this statement, ratification has not occurred.

Cargo tank size limitations are carried into the proposed regulations with the effective dates specified in Public Law 93-119. The change in dates affects existing vessels as defined in the definition section. The requirements of cargo tank arrangement and size apply to (1) new tank vessels, (2) tank vessels delivered after January 1, 1977, and (3) existing tank vessels: (a) delivered after January 1, 1977; or (b) delivered before January 1, 1977, and for which the building contract is awarded after January 1, 1972; or in the case where no building contract exists, the keel is laid or the vessel is at a similar stage of construction after June 30, 1972.

Cargo tanks must be of such size and arrangement that:

a. The hypothetical outflow for side damage or for bottom damage anywhere within the length of the vessel must not exceed 30,000 cubic meters or $400 \sqrt[3]{DWT}$, whichever is greater, limited to a maximum of 40,000 cubic meters.

b. The volume of wing and center cargo tanks must be less than the allowable volumes.

c. The length of cargo tanks must be less than the allowable length.

The hypothetical and maximum hypothetical outflows, allowable volumes and allowable lengths are calculated in accordance with Appendix A of the proposed regulations.

2.6.6. Subdivision and Stability

The following damage stability criteria will be imposed on new tank vessels:

a. The final waterline, taking into account sinkage, heel and trim, must be below the lower edge of any opening through which progressive flooding may take place.

b. In the final stage of flooding, the angle of heel due to unsymmetrical flooding is not to exceed 25 degrees, except that this angle may be increased to 30 degrees if no deck edge immersion occurs.

c. The stability in the final stage of flooding is to be investigated and may be regarded as sufficient if the righting lever curve has a range of at least 20 degrees beyond the position of equilibrium in association with a maximum residual righting lever of at least 0.1 meter.

Calculations demonstrating compliance with the damage stability criteria must be submitted to the Coast Guard for review.

Loading and damage assumptions must be made before the damage stability criteria can be applied. These assumptions are detailed in Appendix B of the proposed regulations. The loading assumptions specify that the vessel be floating at any operating draft which reflects an actual partial or full load condition, consistent with trim and strength of the vessel. Appendix B requires that the extent and character of the assumed side or bottom damage, defined in Appendix A, must be applied, except longitudinal bottom damage within 0.3L from the forward perpendicular must be assumed to be the same as that for side damage. The damage is applied to all conceivable locations along the length of the vessel with some exceptions regarding the engineroom for smaller vessels. Details for handling damage involving a transverse bulkhead, damage between transverse bulkheads spaced less than the extent of assumed damage, damage involving stepped bulkheads and damage within which pipes, ducts and tunnels are situated are also specified. These proposed regulations will require that the master be provided with information which has been approved by the Coast Guard, which, when followed, will ensure that the vessel will comply with the damage stability requirements.

Appendix A of the regulations details damage assumptions for longitudinal, transverse; and vertical extent for use in determining the hypothetical outflow in both side damage and bottom damage cases. The detail calculations for hypothetical outflow are then specified along with some special assumptions if double bottoms or double sides are fitted. Incentive in the nature of credit on outflow is allowed for arrangements incorporating double bottoms and/or double sides.

Included as part of the cargo tank arrangement requirements are special provisions for ensuring the segregation of cargo tanks from each other through the use of valves or similar devices in piping systems running through the tanks. These special provisions are to reduce oil outflow in case of damage.

Cargo tank size limitation is the only section of the design requirements in the proposed regulation which is not totally new. This section was enacted by reference in the Oil Pollution Act of 1973 (P.L. 93-119); however, it does not become effective until the 1971 amendments to the 1954 Convention have been ratified by the United States.

3. PROBABLE IMPACT OF THE PROPOSED ACTION ON THE MARINE ENVIRONMENT

3.1 The Need for Regulations

The desirability of reducing the occurrence and effects of oil pollution is accepted by nearly everyone. Increasing concern during the last several years over the possible effects of petroleum hydrocarbons in the marine environment has resulted in a number of studies and in the passage of new laws aimed at reducing oil pollution. This concern has also been expressed in terms of goals for eliminating or reducing oil pollution, such as that contained in IMCO Assembly Resolution A.237(VII) (October 12, 1971): "The complete elimination of intentional pollution by oil and other harmful substances and the minimumization of accidental discharges of such substances... by 1975 if possible, but certainly by the end of the decade."

Many of the results and pronouncements to the public by experts on the possible effects of oil in the marine environment have been conflicting; some have been alarming; most have been difficult for laymen to evaluate and put in perspective.[8]

Recognizing the need for a comprehensive review of the state of knowledge in this area, the Ocean Affairs Board of the National Research Council -- National Academy of Sciences organized a workshop on the inputs, fates, and effects of petroleum in the marine environment which was held in May 1973. Background papers were reviewed and discussed by some 60 scientists and engineers from academic, governmental, and industrial organizations, both U. S. and foreign. Based on the results of this workshop and additional information developed in the intervening period, the National Academy of Sciences published a report in January 1975 entitled, Petroleum in the Marine Environment.

The Coast Guard believes that this report represents the best collective judgement of experts in the various fields of science and engineering concerned and that the report forms a sound basis for judgements concerning the need for pollution prevention measures. Because the NAS report makes available to the public in a concise form much detailed information on the fates and effects of oil in the marine environment, the Coast Guard believes no attempt need be made to duplicate such information and analysis here in this impact statement.[9]

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[8] There have been some widely publicized claims that the ocean is rapidly becoming irreparably contaminated by oil spills. For example, Jacques Cousteau has stated that 40 percent of all life in the sea has been eliminated by man's activities. (Reference 4)

[9] The report is available from the National Academy of Sciences Printing and Publication Office, 2101 Constitution Avenue, N. W., Washington, D. C. 20418 at $6.50 per copy.

Section 5 of the NAS report, containing the conclusions reached, is included in Appendix B of this impact statement. The following statements quoted from that material are particularly relevant.

> The fate of most petroleum spills on the sea appears to be a combination of evaporation and decomposition in the atmosphere plus oxidation by chemical and biological means to CO_2. The heavier fraction of petroleum forms pelagic tar. The total amount of petroleum on the open sea in the form of specks and floating lumps is estimated to be less than a year's input. Some fraction of this amount eventually becomes washed up on beaches and incorporated into coastal sediments. It is this portion of spilled oil that causes most public complaints. Tar masses are appearing in increased quantity in formerly unpolluted areas such as the East Coast of Africa, the beaches of Southern France, and many islands in both the Indian and Atlantic oceans. Recent reports clearly document the quantity and nature of these tar residues in areas such as Bermuda. The fact that these tars frequently have inclusions of paraffinic wax such as that originally formed on tanker compartment walls and that they have much higher iron contents than natural petroleum is evidence that most of these materials originate from tanker washings and bilge discharges, rather than diffused sources of petroleum input or seeps.

> When oil becomes incorporated in coastal sands protected from the weathering effects of sun and oxygen, its residence time may be measured in years or decades. Unless steps are taken to reduce the input to a level that can be assimilated through natural degradation processes, we will all have to reconcile ourselves to oil-contaminated beaches.

> Fish do not appear to suffer from oil spills as much as seabirds and benthic organisms. Fish may acquire an oily flavor from feeding on oil-contaminated organisms, and widespread tainting of fish flesh may persist as long as significant quantities of oil are present. A long-range hazard exists for some birds such as auks and penguins because they have such slow reproductive rates that marked increases in mortality may be causing their gradual elimination.

The most damaging, indisputable adverse effects of petroleum are the oiling and tarring of beaches, the endangering of seabird species, and the modification of benthic communities along polluted coastlines where petroleum is heavily incorporated in the sediments. The first two of these effects occur predominantly from discharges and spills of tanker and ship operations. The toxicity and smothering effect of oil caused mortality in all major spills studied, with pelagic diving birds and intertidal to subtidal benthic organisms being most affected. Mortality was greatest where oil spills were confined to inshore areas with abundant biota. The effects were generally quite localized, ranging from a few miles to tens of miles, depending on the quantity of petroleum involved.

In general, much more research regarding the fates and effects of petroleum hydrocarbons in the marine environment is needed. We know that the quantity of floating tar in the open ocean and of tar along coastlines has been increasing, that major spills and localized continuous discharges of petroleum hydrocarbons have damaged various species of marine life, and that low levels of petroleum may affect the behavior patterns of certain species. Studies to date indicate that areas polluted with petroleum hydrocarbons "recover" within weeks or years (depending on local conditions and the characteristics of the petroleum); however, composition of the local biological communities may be altered. The oceans have considerable ability to purify themselves by biological and chemical actions. A basic question that remains unanswered is, "At what level of petroleum hydrocarbon input to the ocean might we find irreversible damage occurring?" The sea is an enormously complex system about which our knowledge is very imperfect. The ocean may be able to accommodate petroleum hydrocarbon inputs far above those occurring today. On the other hand, the damage level may be within an order of magnitude of present inputs to the sea. Until we can come closer to answering this basic question, it seems wisest to continue our efforts in the international control of inputs and to push forward research to reduce our current level of uncertainty.

To estimate as accurately as possible the amount of petroleum hydrocarbons entering the marine environment, a panel of experts from various professional disciplines was assembled as part of the NAS effort. Best estimates were developed for each significant petroleum source based on the limited reliable data available and modified by judgement based on experience. Table 1, taken from the NAS report, summarizes estimates of inputs from all significant petroleum sources. These sources range in type from extremely diffuse sources to occasional major point sources of variable location such as tanker accidents. The report points out that the importance or significance of a particular source depends not only on its relative size, but also on the nature of the source and the scope and degree of possible effects.

The figures in Table 1 indicate "Transportation" sources contribute approximately 35 percent (2.113/6.113) of the total ocean inputs. Jumping ahead for a moment, to the more detailed estimates of oil inputs from tankers presented in Table 4, tankers contribute about 22 percent (1.35/6.113) of the worldwide total. Approximately 18 percent (1.087/6.113) of the worldwide total is from tanker tank cleaning and ballasting.

The problem of oil pollution from tank vessels is a very complex one. While a number of factors are known, many aspects are unknown. As with any complicated problem, the answer should come easier if it is approached systematically. In this case, that means gathering information about oil pollution from tank vessels, analyzing the information to understand the problem as well as possible, and then developing regulations which are responsive to the problems.[10]

This is a continuous process. As more is learned, improved solutions will be forthcoming. Action cannot be postponed until all the facts are known. But, on the other hand, the problem must be understood well enough that the regulations are worth the cost and help achieve the goal.

The hazards to the marine environment created by tanker oil pollution may be categorized as those due to:

- routine, long-term injection of oil into the world's oceans
- fairly frequent, but low level introduction of oil into a specific locality such as around an oil terminal or harbor
- relatively infrequent catastrophic large spills concentrated in a relatively small geographic area

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[10] Of course, the Coast Guard is not the only one working on solutions, nor are regulations the only way to achieve improvements.

Table 1.--Budget of petroleum hydrocarbons introduced into the oceans

Source	Input rate (mta)[a] Best estimate	Probable range
Offshore production	0.08	0.08-0.15
Transportation		
LOT[b] tankers	0.31	0.15-0.4
Non-LOT tankers	0.77	0.65-1.0
Dry docking	0.25	0.2-0.3
Terminal operations	0.003	0.0015-0.005
Bilges, bunkering[d]	0.5	0.4-0.7
Tanker accidents	0.2	0.12-0.25
Nontanker accidents	0.1	0.02-0.15
Coastal refineries	0.2	0.2-0.3
Atmospheric rainout[c]	0.6	0.4-0.8
Coastal municipal wastes	0.3	-
Coastal, nonrefining, industrial wastes	0.3	-
Urban runoff	0.3	0.1-0.5
River runoff	1.6	-
SUBTOTAL	5.513	
Natural seeps	0.6	0.2-1.0
TOTAL	6.113	

[a] mta, million metric tons annually.
[b] LOT is an abbreviation for "Load-on-top".
[c] Based upon assumed 10 percent return from the atmosphere.
[d] For all ships equivalent to an average loss per ship of about 10 tons per annum.

Source: National Academy of Sciences Report, Petroleum in the Marine Environment, Washington, D. C., 1975, page 6.

These risks are not all the same. The environmental impact in each case depends on a great many factors, including size, frequency, and locality of oil input, oil type, oceanographic conditions, meteorological conditions, turbidity, season, biota types present, and methods of spill cleanup. The "risk" or expected loss depends not only on the damage that will result from some oil input, but on the likelihood of that input occurring. At present, no systematic method of assessing and comparing these various risks is available. Much of the information needed to determine the risks and impacts of spills has not been developed. There is no way of comparing, for example, the risks associated with the oil entering the ocean from routine tank cleaning to those connected with some smaller amount spilled as a result of a tanker grounding concentrated in a relatively small geographic area.

Ideally, pollution prevention regulations should be aimed directly at reducing risk of environmental damage. However, since direct assessment of such risks is not possible, the Coast Guard feels that highest priority must be placed on bringing the largest volume of oil inputs under control. Tank cleaning and ballasting of tankers are responsible for approximately 80 percent of the oil entering the oceans from tankers and about 18 percent of the worldwide total.[11]

Because of tanker ownership and trade patterns and the international nature of world shipping, the Coast Guard has concluded that <u>international</u> control of oil inputs from tank cleaning and ballasting of tankers is absolutely essential. The 1973 Marine Pollution Convention, while not achieving all that the Coast Guard would have liked, particularly in the area of accidental protection, offers the potential for effectively controlling oil inputs from tanker operations and reducing them to acceptable levels. In the Coast Guard's judgement, the Convention deserves wholehearted U. S. support and should serve as the basis for regulations for U. S. ships and foreign ships entering U. S. waters issued under the Ports and Waterways Safety Act of 1972.

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[11] Tanker accidents contribute some 15 percent of the tanker total and about 3 percent of the world total.

3.2 Oil Inputs to the Oceans from Tankers

An understanding of oil inputs to the marine environment from tankers is needed before the impact of these regulations can be assessed. Information on the tank vessel population, how tank vessels are utilized, and how this utilization may contribute to oil pollution is presented below.

In this statement the term tanker has been used to refer generally to all vessels carrying oil cargoes in bulk, both ships and barges. There are about 6,300 tankships in the world today, ranging from small harbor and coastal tankers to very large crude oil carriers of up to 500,000 deadweight tons. There are currently about 230 active U. S. tankships of 1,000 gross tons or more. To meet anticipated future needs, there were, as of January 1, 1975, 1,118 vessels of 12,000 tons deadweight and above on order worldwide. Averaging nearly 160,000 tons deadweight in size, this fleet of about 176 million tons capacity was almost equal in carrying capacity to the existing world fleet of tankers (about 250 million tons). However, the demand for tankers has decreased as a result of a sharp drop in the growth of world oil consumption due to four-fold price increase by cartel countries last year. This has led to a surplus of tonnage, layups of idle tankers, and cancellation of orders for new tankers. Almost no new orders for large tankers were placed during the last 6 months of 1974; about 40 contracts (totaling 9 million tons deadweight) were cancelled as a direct result of tanker market conditions. (6)[12] The number, size and type of new ships built in the future depends on a great number of factors including energy policy, oil imports, economic conditions, development of U. S. deepwater ports, the tanker market, and the effect of Maritime Administration subsidy program on U. S. tanker construction. Table 2 provides additional information on U. S. and world tankship fleets.

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[12]Numbers in ( ) refer to references listed on pages 225-227.

TABLE 2 U. S. and World Tank Ship Fleets Existing and on Order as of December 31, 1973
(Ocean-going Vessels 2000 Gross Tons and Over)

	Existing				Under construction or on order			
	Worldwide		U. S.		Worldwide		U. S.	
Deadweight Tonnage	no.	deadweight[a]	no.	deadweight[a]	no.	deadweight[a]	no.	deadweight[a]
under 20,000	1,566	18.2	95	1.3	173	1.5	0	0
20,000 to 70,000	1,893	70.5	198	6.5	301	11.2	39	1.7
over 70,000	1,104	168	19	1.8	779	170	23	3.4
Total	4,563	257	312	9.6	1,253	183	62	5.1

[a]Deadweight in million deadweight tons

Source: Sun Oil Company, Analysis of World Tank Ship Fleet, December 31, 1973, St. Davids, Penna., 19087.

Tank barges have been used to carry oil for many years on our inland river system, and larger seagoing barges are now used to transport oil on coastwise and ocean routes. As of January 1, 1974, there were approximately 350 tank barges certified by the Coast Guard for ocean and coastwise routes. These ranged in size from 150 deadweight tons up to about 35,000 deadweight tons and 600 feet in length. The large integrated tug-barge combinations now entering service operate much as tankships do, washing tanks underway and ballasting cargo tanks on ballast voyages. More conventional seagoing towed-barge operations do not involve washing tanks at sea or ballasting cargo tanks.

Total world oil production in 1973 was approximately 2,800 million metric tons (7). Of this total, an estimated 1,400 million tons of crude oil and 290 million tons of products were transported by sea in the 6,000 tank vessels mentioned above.

Tankships and barges may be broken down into two groups according to how they are used -- those that carry crude oil from where it is produced to where it is to be refined, and those that carry petroleum products from refineries to terminals and distribution points. These are not fixed groups -- vessels may shift from one trade to another as transportation requirements change. The current patterns of tanker utilization have evolved over the years as a result of prevailing trade patterns, economic factors, and refinery locations.

In general, larger tankers (over 100,000 deadweight tons) are used for carrying crude oil and smaller tankers (under 40,000 DWT) are used to transport refined products. Intermediate sized ships (40,000 DWT - 100,000 DWT) are often used to carry either crude oil or residual fuel oils resulting from the refining process. The U. S. flag tankship fleet makes up only a small fraction of the world fleet, and, in general, U. S. tankers are smaller and older. New tank vessels, added to the U. S. fleet as a result of the Merchant Marine Act of 1970, have countered this trend to some degree. Most of the U. S. flag tankship fleet is engaged in transportation of crude oil or refined products on domestic routes (protected from foreign competition) or to the U. S. from the Caribbean or other nearby foreign areas. A small number of recently built large tankers are used to carry crude oil in world trade. A number of these vessels will be used to carry crude oil from Alaska to the U. S. once the Trans-Alaska Pipeline is completed. Estimates of vessel requirements and vessels available for this service are shown in Appendix D.

Since current patterns of tanker utilization have evolved as a result of world trade patterns, economic factors, and refinery locations, changes in these variables will result in new patterns of tanker utilization. Such factors as location of new refineries and reduction of oil imports will influence transportation patterns. No attempt has been made in this statement to predict such factors or their effects on tanker utilization.

Information on the shipment of oil into U. S. ports during 1972 is presented in Table 3. Crude oil and residual fuel movements have been lumped together in Table 3 since they represent similar problems as far as shipboard pollution control measures are concerned.

TABLE 3 Transportation of Oil by Water into U. S. Coastal Ports[1]

Cargo	Source	Shipment on	Estimated Amount (mta)[2]
Crude oil and residual fuel	Foreign	Foreign Ships[3]	186
Crude oil and residual fuel	Foreign	U. S. Ships[3]	10
Crude oil and residual fuel	U. S.	U. S. Ships	62
Crude oil and residual fuel	U. S.	U. S. Barges	7
Refined oil	Foreign	Foreign Ships[3]	23
Refined oil	Foreign	U. S. Ships[3]	1
Refined oil	U. S.	U. S. Ships	79
Refined oil	U. S.	U. S. Barges	19
TOTAL			387

[1]Amounts are for calendar year 1972 and are taken from U. S. Army Corps of Engineers, Waterborne Commerce of the United States, 1972

[2]mta, million metric tons per year

[3]The assumption has been made that 95 percent of the oil from foreign sources is transported in foreign flag ships and 5 percent in U. S. flag ships.

It is important to understand how tankers contribute to oil inputs. Figure 1 shows one way the tanker oil pollution problem may be broken down -- according to source.[13]

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[13]The Coast Guard has already implemented regulations affecting some portions of the problem. Regulations for vessels and oil transfer facilities contained in 33 CFR 154-156 are aimed primarily at spills occurring at the vessel-terminal interface during transfer operations, although they also require storage and transfer facilities on vessels for oil bilge water. Requirements for bridge-to-bridge radiotelephone and development of vessel traffic systems are aimed at reducing vessel accidents.

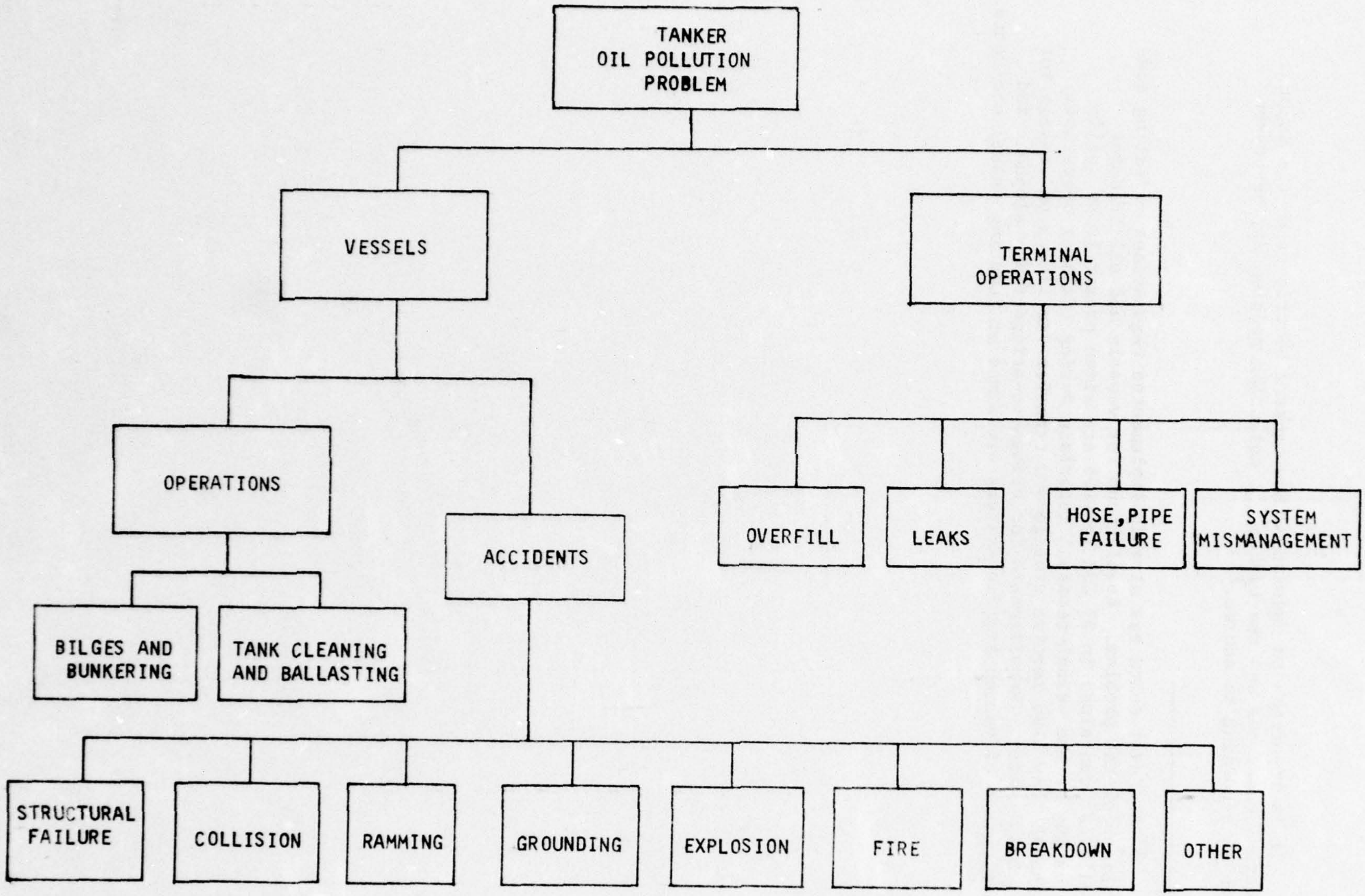

Figure 1. The Tanker Oil Pollution Problem

Tankers contribute to the oil entering the marine environment in four basic ways:

a. tank cleaning and ballasting

b. tanker bilges pumped overboard and bunkering spills

c. spills during loading and unloading of cargo at terminals

d. tanker accidents

No one knows exactly how much oil enters the ocean from each of these sources. A number of estimates have been made. These estimates vary widely depending on the choice of assumptions and the information available concerning:

- amount of oil retained on board after discharge of cargo ("clingage")
- number of tanks washed
- oil content of water discharged
- amount of oil leaked to bilges
- quantities of dirty machinery lube oil and purifier sludge produced
- cargo handling spills
- spills due to tanker accidents

Uncertainties concerning information on such factors makes responsible estimates hard to make. But such estimates are necessary to give some idea of the impact of new regulatory requirements. In response to comments on the draft statement, an effort has been made in Table 4 and Figure 2 to estimate oil inputs from various tank vessel sources. Supporting assumptions and calculations are in Appendix E.

The detailed geographic distribution of these oil inputs over the oceans is not known. Obviously, tank washings and oily bilge water are pumped out along tanker routes. Cargo handling spills occur at terminals. The majority of tanker accidents resulting in oil outflows occur at or near harbors in coastal waters (within 50 miles of land). (Reference 4)

The NAS Report (Reference 5 and Appendix B) summarizes past work on determining distribution of oily residue in the ocean. More current efforts are described in reference (9) including a program being conducted by Exxon Corporation under sponsorship of NOAA and MARAD for collecting and analyzing water samples along selected tanker routes.

The Marine Pollution Monitoring Pilot Project, part of the Integrated Global Ocean Station System (IGOSS) Program, sponsored by the United Nations'

TABLE 4 Estimated Annual Oil Inputs to the Oceans from Tankers

SOURCE	Estimated Oil Inputs (thousands of metric tons per year)			
	Worldwide	U. S. Vessels Foreign Trade	U. S. Vessels Domestic Trade	U. S. Waters
Tank cleaning and ballasting				
Ballasting and deballasting operations including associated tank washing, crude oil(1)	426	3	24	29
Tank cleaning for removal of sludge buildup, crude oil(1)	259	1.8	16	19
Tank cleaning of refined product tankers for ballast and to insure purity of next cargo	162	0.5	43	44
Tank cleaning prior to shipyard repairs	240	1.8	7.2	9
SUBTOTAL FOR TANK CLEANING AND BALLASTING	1,087	7.1	90.2	101
Tanker bilges and bunkering	60	0.6	2.3	3
Terminal operations	3	0.02	0.4	0.6

Table continued on next page.

TABLE 4 (cont'd) Estimated Annual Oil Inputs to the Oceans from Tankers

SOURCE	Estimated Oil Inputs (thousands of metric tons per year)				
	Worldwide	U. S. Vessels		U. S. Waters	
		Foreign Trade	Domestic Trade	U.S. Ships	Foreign Ships
Tanker accidents					
Breakdowns	6				
Collisions	40		1	1	0.5
Explosions	20		0.4	0.4	
Fires	1				
Groundings	50	0.6	0.8	0.8	2.4
Rammings	3		0.3	0.3	0.5
Structural Failures	70		6(2)		1.2
Other (including flooding of machinery space)	10				
SUBTOTAL FOR TANKER ACCIDENTS	200	0.6	8.5	2.5	4.6
TOTAL OIL INPUTS FROM TANKERS	1,350	8.3	101.4	111.7	

Notes:
1. For U. S. vessels and U. S. waters, figures shown include those from both crude oil and residual oil. Crude and residual oils have been treated together because presently available LOT methods work for both.
2. Total loss of a 29,950 deadweight ton vessel is included.
3. Estimates for operational pollution inputs are described in Appendix 2.
4. Estimates for tanker accidents are based on period 1969-1973 with data collected from Lloyds Weekly Casualty Reports, CG pollution and vessel casualty reports.

SOURCES OF THE ESTIMATED 1.35 MILLION TONS OF OIL

ENTERING THE OCEANS EACH YEAR FROM TANKERS

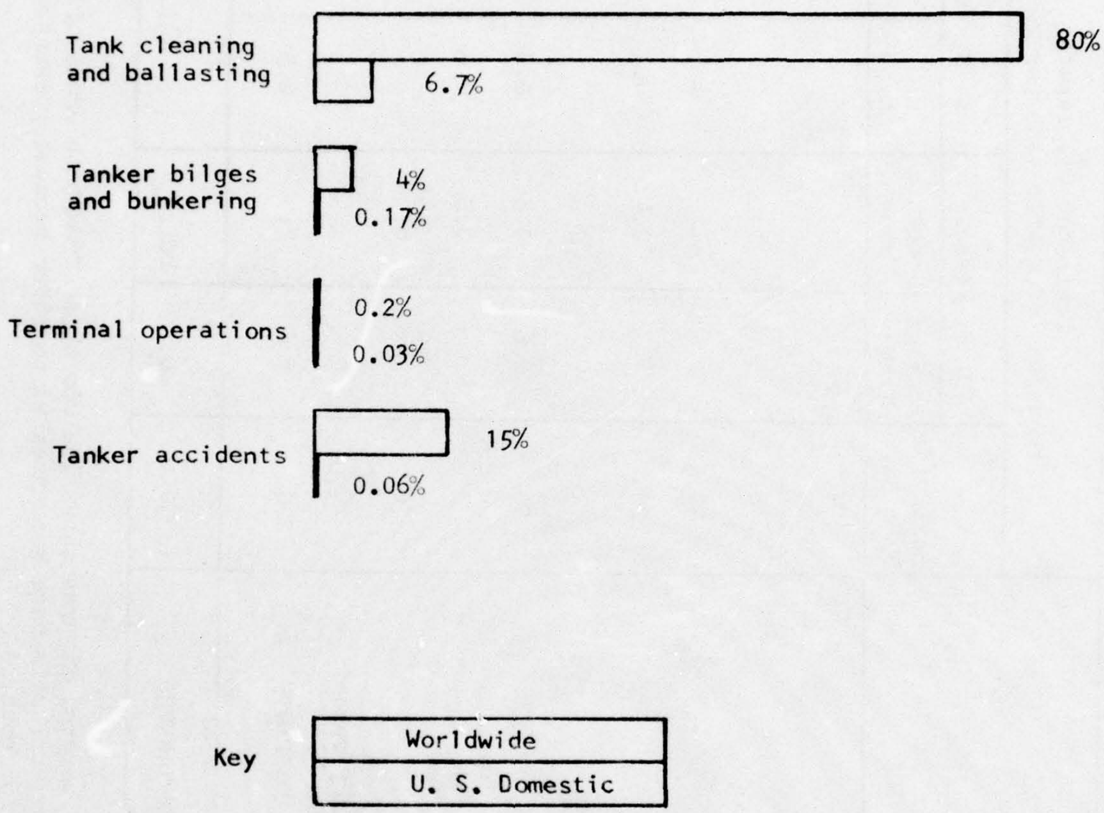

Figure 2. Sources of the estimated 1.35 million tons of oil entering the oceans each year from tankers. (Based on data in Table 4.)

Intergovernmental Oceanographic Commission of UNESCO and the World Meterological Organization, is also described in reference (9).

Tank Cleaning and Ballasting

Tank cleaning and ballasting accounts for approximately one million metric tons of the estimated six million tons of oil entering the marine environment from all sources each year. (Bilges contribute another 60,000 tons, terminal operations 3,000, and tanker accidents 200,000 -- See Table 4.) The following description of tank cleaning and ballasting operations will help in understanding how this occurs.

After discharging cargo, a tank vessel without sufficient segregated ballast tanks will take some sea water aboard in her cargo tanks to ensure proper propeller immersion and to provide handling and sea-keeping characteristics. The amount of ballast taken aboard depends upon the anticipated weather conditions, the distance and route of the ballast voyage, the vessel's lightship displacement (weight), length to depth ratio, and other vessel characteristics. The amount of ballast taken aboard generally varies from 20 to 50 percent of the vessel's total cargo carrying capacity, but may be greater during periods of severe bad weather.

The ballast that is put directly into cargo tanks immediately after cargo discharge comes into contact and mingles with the oil that adhered to the tank surfaces and remained below the suction bellmouths and in the piping after cargo discharge. This oily ballast must be disposed of in some way prior to arrival at the loading port unless the loading port has suitable reception capability. After disposal of the oily ballast, clean ballast suitable for direct disposal into the harbor at the loading port must be taken aboard. In the absence of segregated ballast tanks, empty cargo tanks must be washed to remove the residue oil and provide space for the clean ballast. These tank washings are pumped overboard and the clean tanks are filled with sea water which can be discharged into the harbor at the loading port. The number of tanks washed is a function of the particular vessel's proportions, the weather, the route, and the need to periodically clean tanks for internal inspection, repair at a shipyard, or to control sludge buildup. This generally amounts to between one-third and one-half of the vessel's tanks per ballast voyage. This operation is referred to in this section as "uncontrolled ballast discharge." It results in all of the oil residue from the cleaned tanks and approximately 15 percent of the oil residue from the tanks which were initially ballasted being pumped overboard. The amount of oil influx that results from this operation on any given voyage depends on the amount of oil that remains in the tanks after discharge at the unloading port. This number is commonly referred to as clingage. Clingage ranges from 0.1 percent to 0.9 percent of the cargo capacity depending on the type of oil, the stripping capability of the tanker, the particular cargo piping arrangement, and the internal structure of the tank vessel; it is considered to average 0.4 percent for crude oil.

All tank vessels do not pump the oil residue from their tank cleaning operations directly overboard. With the practice of the "load on top" (LOT) system, the tank cleaning residue (water and oil) is pumped into a holding

tank. Here the mixture is allowed to settle and the water drawn off the bottom so that only oil and a small amount of water remains in the tank. These consolidated slops are then transferred to a reception facility or combined with the next cargo; hence, the term "load on top."

If all tank vessels employed a 100 percent efficient LOT system 100 percent of the time, tank cleaning and ballasting operations would not be a significant source of oil pollution. However, LOT is not being practiced by all tank vessels; where it is, it is estimated to be 90 percent efficient. This is because:

a. the LOT system has not been used by tank vessels in the non-persistent and special oil product trade. Reasons offered for not doing so are unwillingness to mix refined products with one another and problems associated with disposal of this type slop;

b. certain ballast voyages can be so short as to preclude the time necessary for satisfactory operation of the LOT systems;

c. depending on sea conditions, the necessary separation process may not be completely effective;

d. the oil-water interface in the holding tank cannot be accurately determined and this results in a portion of the layer of oil being drawn off the water; and

e. some components of oil are water soluble.

Oil from tank cleaning and ballasting represents about 80 percent of the oil entering the oceans from tankers; tanker bilges and bunkering, cargo handling spills, and tanker accidents are responsible for the other 20 percent.

Tanker Bilges and Bunkering Spills

The amount of oil lost to the sea from this source is difficult to support by means of measured data. The estimates in Table 4 come from reference (5) and are based on an assumed loss per ship of about 10 tons per year for machinery leakage and spills during bunkering.

Cargo Handling Spills

The amount of oil lost to the water as a result of cargo handling spills depends on the number of cargo transfers and the measures taken to avoid such spills. The estimate of 3,000 tons per year from this source in Table 4 is taken from reference (5).

Tanker Accidents

Tanker accidents are responsible for about 15 percent of the quantity oil inputs to the marine environment from tankers. But this input often occurs in a dramatic, concentrated, striking way. Because of this, accidental

pollution has received more attention and public comment than some of the other sources. Estimates in Table 4 are based on references (1) and (4). Tanker accidents are discussed at greater length in Section (4) of this statement.

3.3 Effect of the Regulations on Tanker Oil Pollution

3.3.1. Requirements

For purposes of analyzing their effect on oil pollution from tankers, the regulations discussed in Section 2.3 may be broken down into the following groups.

1. Segregated ballast (157.09)[14]

2. Cargo residue discharge standards and requirements for equipment to retain oily residues on board.

   Pumping, piping, and discharge arrangements (157.11)

   Designated area (157.13)

   Slop tanks in vessels (157.15)

   Cargo and ballast system information (157.23)

   Discharges; seagoing vessels of 150 gross tons or more (157.29)

   Discharge of cargo residue (157.37)

   Instruction Manual (157.49)

3. Bilge discharge standards,

   Oily residue tank (157.17)

   Water ballast in oil fuel tanks (157.33)

   Machinery space bilges (157.39)

4. Cargo tank arrangement and size (157.19)

5. Subdivision and stability (157.21)

3.3.2. Factors Influencing Effects of Regulations

The sea is a complex system and our knowledge of it is imperfect. Much remains to be learned before we can fully assess the impact of varying amounts of pollution of the sea by oil and answer the question, "At what level of petroleum hydrocarbon input to the ocean might we find irreversible damage occurring?" (5) Because of this, it is not possible to say

[14]The numbers in ( ) refer to specific regulations. Refer to reprint of the June 28, 1974, proposed rules contained in Appendix A starting on page 228.

directly what effect these regulations will have on the environment. But action to control and reduce the amount of oil entering the marine environment is clearly prudent until uncertainties over fates and effects of oil are reduced. While the effect of the regulations on environmental quality cannot be assessed, estimates of the effect of the regulations on oil inputs from U. S. tankers can be made.

Figure 3 shows inputs to the process of estimating the effects of the regulations.

Some of these inputs are known or can be estimated (for example, the requirements of the regulations and oil inputs). In view of current economic conditions and energy conservation efforts, considerable uncertainty is involved in predicting amount and route of future oil transport and numbers and sizes of future new ships constructed.

Because of these uncertainties, no time-phased prediction of future effects is possible, but a reasonable idea of the effects can be obtained by determining the direction of change (reduction or addition to oil inputs) and estimating magnitude of effect from recent past experience.

Estimated Effects

These rules cover only U. S. vessels, so they will affect only oil inputs from U. S. vessels.[15]

While these rules are applicable only to vessels in domestic trade, the prospect of their extension to vessels in foreign trade and the benefits of standardized design and series production in ship construction mean that all new U. S. vessels will be built to these standards once they become effective, whether they are intended initially for foreign or domestic trade. Applicability of the various requirement groups to U. S. tankers is shown in Table 5.

It is obvious from Table 5 that some provisions of the regulations will start to take effect soon after they are adopted and others will be longer-term, influencing the amount of oil inputs as newer ships enter service and older ships are retired. Segregated ballast is an example of the latter. The problem of setting dates for the definition of "new vessel" is essentially one of balancing the need for regulations to take effect against the effect that short lead times will have on completed designs and existing contracts. In this case the Coast Guard feels that the previous notices have provided ample notification to industry of the impending regulations and that the dates selected are therefore not unreasonable.[16]

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[15]In order to comply with Title II of the Ports and Waterways Safety Act of 1972, similar rules will be made applicable to U. S. vessels in foreign trade and foreign vessels entering U. S. ports in 1976.

[16]The alternative of applying segregated ballast to existing vessels is discussed on pages 61-62.

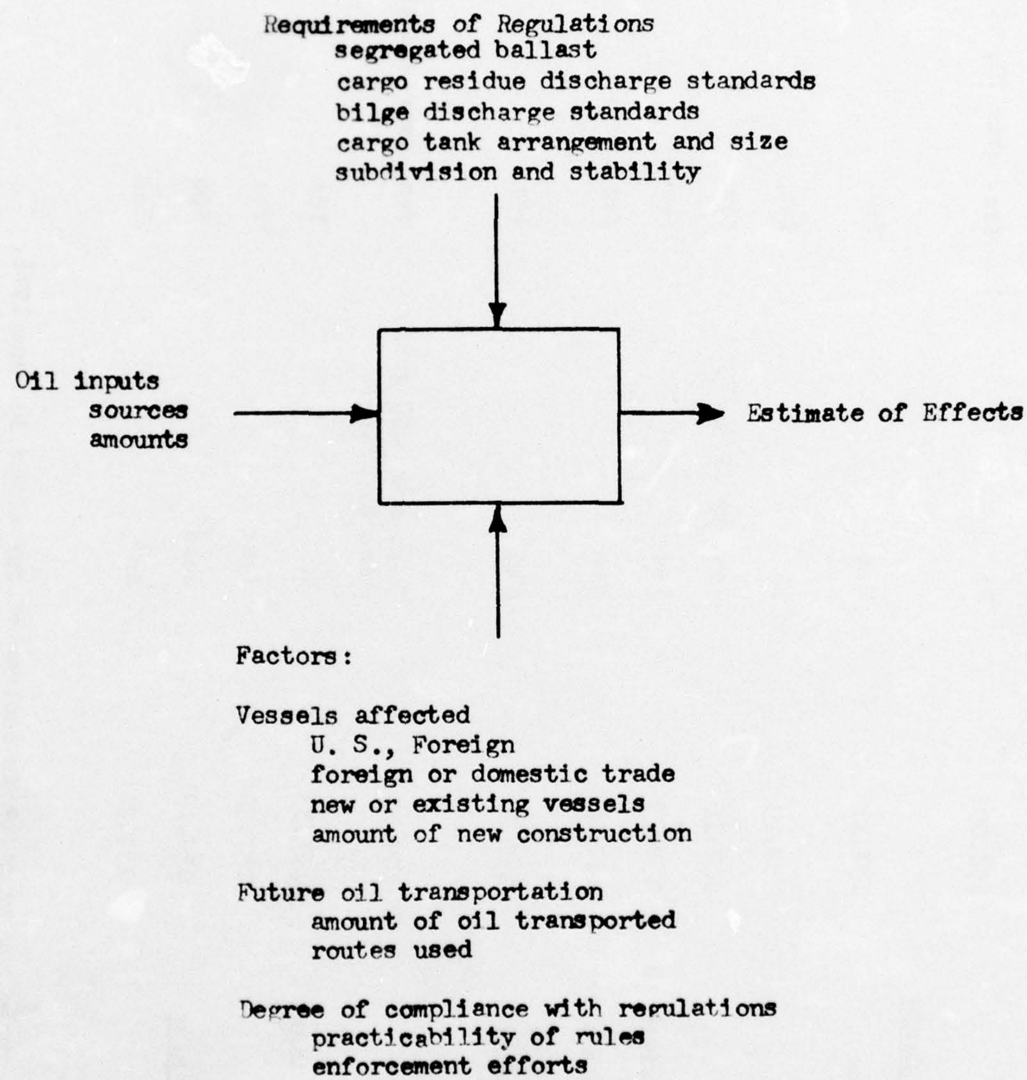

Figure 3. Inputs for estimating effects of regulations

TABLE 5 Applicability of Requirements to U. S. Tankers in Domestic Trade

Requirement		Existing Vessels	New Vessels[1]
Segregated ballast	157.09	No	Yes, over 70,000
Cargo residue discharge standards			
Pumping, piping, & discharge arrangements	157.11	Yes	Yes
Designated area	157.13	No	Yes
Slop tanks in vessels	157.15	Yes, by 12/31/77	Yes
Cargo & ballast system information	157.23	Yes	Yes
Discharges; seagoing vessels over 150 gross tons	157.29	Yes	Yes
Discharge of cargo residues	157.37	Yes	Yes
Bilge discharge standards			
Oily residue tank	157.17	Yes, over 400 gross tons by 1/1/77	Yes, over 400 gross tons
Water ballast in oil fuel tanks	157.33	No	Yes
Machinery space bilges	157.39	Yes	Yes
Cargo tank arrangement and size	157.19	Some[2]	Yes
Subdivision and stability	157.21	No[3]	Yes

[1]"New vessels" are vessels whose construction is contracted for after 30 June 1975.

[2]This regulation applies to vessels whose construction was contracted for after January 1, 1972.

[3]Tankers built in the United States since 1968 have met these requirements.

Segregated ballast on new tank vessels greater than 70,000 DWT should practically eliminate oil inputs from tanker ballasting and associated tank washing for clean ballast from these vessels. The full effect will depend on future U. S. ship construction. As Table 4 shows, segregated ballast offers the potential of much more significant savings worldwide when segregated ballast standards are adopted by other countries.

The cargo residue discharge standards, which are applicable immediately to all existing U. S. tankers in domestic trade as well as to new tankers, will significantly reduce inputs from all of the tank cleaning and ballasting sources listed in Table 4. The regulations apply to oil in any form including non-persistent oils and prohibit any discharge of oily mixtures from cargo residues within 50 miles of land.

The effect of the regulations will be to require that existing vessels and new vessels be equipped to utilize the improved LOT system.[16] Vessels which presently utilize LOT will have to upgrade to an improved method, one with better monitoring and control techniques. Vessels which do not presently use LOT will have to:

a. use improved LOT during a ballast voyage retaining on board that which cannot be discharged

b. transfer residues to a reception facility

To get some idea of the effect of these requirements on oil inputs, if U. S. vessels, tankships in domestic trade used improved LOT, discharging the maximum allowable 1/15,000 of their cargo over 50 miles from land, oil inputs for the quantities transported in 1972 would be as shown in Table 6.

The realization of the reductions in Table 6 depends on (1) availability of shoreside facilities for reception of cargo residues where they cannot or are not mixed with next cargo and dirty ballast tank washings where LOT techniques cannot be used, (2) installation and use of oil content monitors and interface detectors to make LOT operations more effective, and (3) enforcement of the discharge standards.

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[16] LOT refers to "load-on-top." See page 39 for a description of LOT operations

TABLE 6

COMPARISON OF OIL INPUTS FROM TANK CLEANING AND BALLASTING
U. S. TANKSHIPS IN DOMESTIC TRADE

<u>Amounts Presently Permitted versus New Discharge Standard</u>

<table>
<tr><th></th><th colspan="2">Estimated Amount
(Thousands of Metric Tons)</th></tr>
<tr><th>Source</th><th>Present
(Table 4)</th><th>Permitted by
Discharge Standards</th></tr>
<tr><td>Ballasting and tank washing for clean ballast, crude and residual</td><td>24</td><td rowspan="2">4.1</td></tr>
<tr><td>Tank cleaning for sediment control, crude and residual</td><td>16</td></tr>
<tr><td>Tank cleaning, refined product carriers for clean ballast and cargo purity</td><td>43</td><td>5.3</td></tr>
<tr><td>Tank cleaning prior to shipyard repairs</td><td>7.2</td><td>0.3</td></tr>
<tr><td>TOTALS</td><td>90.2</td><td>9.7</td></tr>
</table>

Increased retention of dirty ballast and tank washings where cargoes not amenable to LOT procedures are transported, will increase the need for shoreside oily residue reception facilities. A number of questions on the availability and environmental effects of shore reception facilities to take care of oily ballast, tank cleaning residue, and oily bilge water currently dumped at sea need to be answered:

- Are adequate reception facilities available?

- How will additional required reception facilities be provided?

- Can these facilities be provided and wastes disposed of in an environmentally sound fashion?

The Coast Guard is working now with other government agencies and appropriate segments of the marine industry to assemble and update information on the adequacy of reception facilities. Some information on existing reception facilities is available (10), and an additional survey of such facilities at terminals in the U. S. is being conducted. The requirement for additional reception facilities will depend on numbers and routes of ships entering loading ports, and the U. S. is fortunate, in this case, to be an importer rather than an exporter of crude oil. Reception facility design and capacity will also depend on the type of oil and amount left on board after cargo discharge. A study conducted by Exxon before the 1973 Marine Pollution Convention (11) and on EPA study on clean products (12), represent the major works in this area.

If additional facilities are required, they will presumably be provided by terminal operators, port authorities, or ship repair yards. Limitations on trade into a port or other restrictions may have to be made to induce terminals, port authorities, or shipyards to invest in the necessary facilities.

Experience with present facilities seems to indicate that waste waters can be satisfactorily treated, although additional improvements in treatment plants will probably be required as states and local jurisdictions upgrade their discharge standards.

Load-on top (LOT) procedures have been used by many of the world's tanker operators for a number of years. Their effectiveness depend on careful stripping and flushing of cargo tanks and lines, careful sounding of slop tanks to locate the oil/water interface, and close visual observation of the overboard discharge to determine when discharge should be stopped. The discharge criteria contained in the regulations and the 1973 Marine Pollution Convention are based on results achievable with somewhat improved LOT methods. More careful attention to slop tank and piping design and use of instruments to more accurately determine oil content of overboard discharges and location of oil/water interface in slop tanks improve the effectiveness of the LOT techniques that have been used in the past. They make it easier to do a better job.

At least one oil content monitoring device suitable for use on tankers is commercially available and has been installed on a number of ships. The Convention requires oil content monitors and interface detectors be approved by the national administration (by the U. S. Coast Guard in our case) and the Coast Guard is developing specifications for monitors, interface detectors, and oily water separators which will be published for public comment as rapidly as possible. It is not possible to give a firm date for publication of regulations on this equipment. Work has been underway over the past year on development of test specifications and steps to provide equipment test facilities. The Coast Guard has been working with appropriate facets of the U. S. marine industry and other government agencies and also with the Marine Environmental Protection Committee of IMCO. The Coast Guard feels that regulations must be based on facts and that developing and carefully testing good specifications is essential. Once specifications have been published and devices tested and approved, an assessment can be made as to a reasonable deadline for mandatory installation and use of the equipment. While oil content monitors and interface detectors will make LOT easier and more effective, the improvement is small compared to the much larger improvement resulting from a tanker operator's commitment to use LOT methods at all. It is important therefore to go ahead with regulations establishing discharge criteria which require that LOT (or more properly, retention-on-board) techniques be used.

The effectiveness of LOT techniques depends largely on the training and dedication of the shipboard operator. Enforcement of the standards will depend on oil record book entries, oil content monitor traces, audits of slops delivered to terminals and aerial surveillance. Under the 1961 Act, it is possible for oil record books to be falsified. The proposed regulations should help cure this problem, as oil record book entries can be tied to ship's navigation position. The expanded oil record book will account for all oil received, discharged and internally transferred. Greater specificity of information entered and tank-by-tank information requirements will greatly facilitate efforts in detecting violations of the regulations.

The bilge discharge standards allow oily mixtures from machinery space bilges containing up to 100 ppm of oil to be discharged outside of 12 miles from shore. Laws already in effect require that discharges within 12 miles of land must not leave a visible sheen. Discharges must be made through an oily water separator or an oil discharge monitoring and control system which records the oil content and automatically stops the discharge if allowable oil content is exceeded.[17] Oily ballast from fuel tanks of existing tank vessels must be similarly treated; new vessels may not ballast fuel tanks. These standards will reduce oil inputs from tanker bilges and bunkers, but how much is hard to say because of the number of variables involved in bilge accumulation and oil content. There will be an increased need for shore disposal and oil reprocessing facilities where waste oil, purifier sludge, etc. cannot be reused on the vessels.

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[17] The Coast Guard has not yet proposed specifications for either of these items. The discussion of oil content monitors and oily water separators discussed under the heading, cargo residue discharge standards above, applies to these items also.

Cargo tank arrangement and size: Another provision included in the regulations relates to the arrangements of vessel tanks and limitations of tank size for new tank vessels and some existing tank vessels. The objectives of these provisions are to place an upper limit on the quantity of oil which can escape into the sea as a result of collision, grounding or other vessel casualty. Certain ships even now under construction would have to comply with the tank arrangement and size limitations. That provision would apply to tank vessels presently under construction which will be completed after January 1, 1977, and to vessels completed before this date but which were started after January 1, 1972.

The regulation is written assuming damage conditions for both collision and grounding situations. These values represent severe assumed injuries in such accidents and are to be used to determine, by trial at all conceivable locations, the worst combination of compartments which would be breached by such an accident. The consequence of these injuries should not exceed the hypothetical outflow limits mentioned earlier, thereby providing criteria for vessel design and encouraging use of double bottoms, double sides, void spaces and segregated ballast.

The effect of cargo tank arrangement and size is largely one of reducing the potential size of future outflows due to tanker accidents from what might have resulted if the trend toward larger individual tanks had been allowed to continue.

The effect of subdivision and stability requirements on oil outflows also depends on the number of new ships entering service. These requirements will improve the ability of tankers to remain afloat after flooding of cargo or machinery spaces:

Vessels over 225 meters long (738 feet, approximately 50,000 DWT)	Must be able to survive flooding of any two adjacent compartments
between 225 meters and 150 meters (492 feet, approximately 13,000 DWT)	flooding of machinery space or any two other adjacent compartments
less than 150 meters	flooding of any single compartment other than machinery

These measures will decrease risk of accidental outflow from collisions and flooding of machinery space by increasing survivability of new vessels. For example, of the 47 tankers, over 10,000 DWT lost at sea during the period 1969-1973, six of the losses involved flooding of the machinery space. The circumstances in these cases are such that it appears the new subdivision and damage stability requirements could have prevented loss of these ships and resulting oil outflow.[18]

Table 7 summarizes the expected effects of these regulations on the oil inputs from U. S. tankers. The cargo discharge residue standards contribute the bulk of the reduction -- an estimated 80,000 metric tons per year.

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[18]These losses are: ANASTASIA J. L., GEZINA BROVIG, ALKIS, GUISEPPE GIULI, PLOIESTI, and the TRADER.

TABLE 7

EXPECTED EFFECTS OF REGULATIONS ON OIL INPUTS TO THE SEA FROM U. S. TANKERS

	Segregated Ballast	Cargo Residue Discharge Standards	Bilge Discharge Standards	Cargo Tank Arrangement and Size	Subdivision and Stability
Tank cleaning and ballasting					
Ballasting and deballasting and associated tank cleaning	decrease for new vessels over 70,000 DWT	decrease significantly for all vessels 35.9[a]	-	-	-
Tank cleaning for sediment control crude oil	-	decrease for all vessels	-	-	-
Tank cleaning of refined product tanker for ballast and for cargo purity	-	decrease for all vessels 37.7	-	-	-
Tank cleaning prior to shipyard repairs	-	decrease for all vessels 6.9	-	-	-
Tanker bilges and bunkering	-	-	decrease for all vessels	-	-
Terminal operations	-	-	-	-	-

[a]Amounts shown are the reduction of annual oil input in thousands of metric tons based on Table 6.

TABLE 7 (Continued)

EXPECTED EFFECTS OF REGULATIONS ON OIL INPUTS TO THE SEA FROM U. S. TANKERS

	Segregated Ballast	Cargo Residue Discharge Standards	Bilge Discharge Standards	Cargo Tank Arrangement and Size	Subdivision and Stability
Tanker Accidents					
Breakdowns	-	-	-	small decrease	decrease
Collisions	decrease	-	-	decrease	decrease
Explosions	decrease (less tank cleaning)	-	-	decrease	-
Fires	-	-	-	-	-
Groundings	decrease	-	-	small decrease (DB incentive)	decrease
Rammings	decrease	-	-	-	-
Structural Failures	unknown	-	-	unknown	decrease
Other	-	-	-	-	decrease

3.4 Other Impacts of the Regulations

The economic impact, technical feasibility, and safety impact of the regulations are discussed in this section.

Economic Impact

The regulations require a number of actions be taken by shipowners and operators in an effort to reduce oil inputs to the oceans. These actions will require additional capital investment in vessels and equipment and increase operating costs. These increased costs will ultimately be passed on to the consumer as increased transportation costs and higher prices for petroleum products. The actions required by the regulations are shown in Table 8.

The largest cost associated with these regulations is the increase in construction cost to provide segregated ballast space on new tankers over 70,000 deadweight tons. Various estimates of cost increases to provide segregated ballast have been made. A study submitted by the United States to IMCO prior to the 1973 Pollution Conference estimated the increase in required freight rate to range from about 4 percent to as much as 10 percent, depending on ship size, voyage length, how the ballast was distributed (staggered wing, double bottom, double skin, etc.), and a host of other variables.[19] It should be noted that these costs are representative, but not necessarily optimum (no effort was made to optimize individual designs since the study was done to compare various segregated ballast designs) and depend on a great many assumptions involving some uncertainty.

Required freight rate depends on vessel size and length of voyage. Some typical rates, their contribution to oil prices and the effect of a 10-percent increase in required freight rate are shown in Table 9.

In addition to increasing the cost of new tanker construction, the regulations will require installation of monitoring and control equipment and piping changes to both new and existing vessels at an estimated cost of $200,000 per vessel. This is, of course, small compared to the increased construction costs discussed above (say 5 percent increase on a $30 million ship, or $1.5 million) so its effect on costs will also be small.

Another requirement that will raise transportation costs which is not included in Table 9, is shore reception facilities.

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[19] Required freight rate (RFR) is commonly used as a measure of vessel profitability. It is defined as the income, per unit of cargo, that a shipowner must collect in order to earn returns equivalent to the repayment of his investment plus some arbitrary (but reasonable) rate of interest. (Reference 24) RFR takes into account amortization of capital costs as well as operating costs. See Table 7 of Reference 13, Part 1 and page xi of Part 2, for additional background on increase in RFR due to additional construction cost of segregated ballast.

TABLE 8

Action Required by Regulations

Requirement	Existing Vessels	New Vessels
Segregated ballast tanks	Not required	For vessels over 70,000 DWT, increasing size of ship by approximately 20% for same payload results in construction and operating cost increases. Additional pump and piping for segregated ballast system Additional design cost to locate segregated ballast
Cargo residue discharge standards		
Pumping, piping and discharge arrangements	Install new discharge line	Install new discharge line
Designated area	Not required	Locate area so overboard discharge can be observed Install pump shutoff control
Slop tanks	Designate slop tank, modify piping by December 31, 1977	Design and install slop tank system

TABLE 8 (Continued)

Action Required by Regulations

Requirement	Existing Vessels	New Vessels
Cargo and ballast system information	Prepare information	Prepare information
Discharge of cargo residue	Install oil discharge Monitoring and control system. Use LOT procedures. Dispose of slops ashore Cost of reception facilities. Delay in port to discharge slops Additional time at Sea for LOT	Install oil discharge Monitoring and control system. Use LOT procedures Dispose of slops ashore Cost of reception facilities Delay in port to discharge slops Additional time at sea for LOT
Bilge discharge standards		
Oily residue tank	Install tank Alter piping	Install tank and piping
Machinery space bilges	Oil discharge monitoring and control system or oily water separating equipment	Oil discharge monitoring and control system or oily water separating equipment
Cargo tank arrangement and size	Not required	Additional design calculations Restrict tank size
Subdivision and stability	Not required	Additional design calculations

TABLE 9

TYPICAL TRANSPORTATION COSTS
for
TANKER OIL SHIPMENTS

Voyage	Venezuela - U.S. East Coast	Persian Gulf - U.S. East Coast
Ship	20,000 DWT	150,000 DWT
Approximate Required Freight Rate (RFR)	$0.32/bbl	$0.70/bbl
Assumed Cost of Crude Oil	$ 12/bbl	$ 12/bbl
% of Cost represented by Ocean Transportation	2.7%	5.8%
Maximum Estimated % Increase in RFR[19a]	10%	10%
$ Increase in RFR	$0.03/bbl	$ 0.07/bbl
(Price Increase required to cover increased transportation cost)	(0.07 cents/gal)	(0.17 cents/gal)

19a See page 53 for discussion of range of estimates for increased RFR and factors influencing RFR.

In addition, there will likely be some additional costs for enforcement of the new standards by the Coast Guard. Some additional plan review and inspection will be required. Vessel boarding and aerial surveillance may be required to provide effective enforcement of the discharge standards.

Technical Feasibility

The achievement of the discharge standards in the regulations, the same standards as those in the 1973 Marine Pollution Convention, is considered technically feasible. Improvements in the oil content monitors now available, particularly for refined products, are needed to improve separation of oil from water on board ships to optimum levels, but these improvements are not necessary to achieve the bulk of the possible improvement.

Safety Impact

The regulations, directed at pollution control, will also have safety benefits. Segregated ballast on ships over 70,000 DWT will give additional protection from damage from collisions and groundings (and fires which sometimes occur as a result). Subdivision and stability requirements will contribute to survivability of new tankers after damage also.

The piping system requirements and segregated ballast distribution requirements will increase complexity of tankers and may make proper inspection and repair of tank interiors more difficult. The Coast Guard does not feel these potential problems are serious enough to warrant rejecting these requirements.

4. ALTERNATIVES TO THE PROPOSED ACTION AND FUTURE ACTIONS PLANNED BY THE COAST GUARD

4.1 Introduction

Title II of the Ports and Waterways Safety Act of 1972, which amended the Tank Vessel Act (46 U.S.C. 391a), states in Section 201(7)(A):

> "The Secretary shall begin publication as soon as practicable of proposed rules and regulations setting forth minimum standards of design, construction, alteration, and repair of the vessels to which this section applies for the purpose of protecting the marine environment. Such rules and regulations shall, to the extent possible, include but not be limited to standards to improve vessel maneuvering and stopping ability and otherwise reduce the possibility of collision, grounding, or other accident, to reduce cargo loss following collision, grounding, or other accident, and to reduce damage to the marine environment by normal vessel operations such as ballasting and deballasting, cargo handling, and other activities."

Congress thus directed that rules be developed in three areas:

a. standards to improve vessel maneuvering and stopping ability and otherwise reduce the possibility of collision, grounding, or other accident;

b. standards to reduce cargo loss following collision, grounding, or other accident; and

c. standards to reduce damage to the marine environment by normal vessel operations such as ballasting and deballasting, cargo handling and other activities.

It has not been possible for the Coast Guard to develop rules comprehensively covering all of these problems in the time period since the Ports and Waterways Safety Act became law. The rules for tank vessels in domestic trade, constituting a first step toward the body of rules and regulations that will ultimately be required to fully implement the Act, concentrate primarily on the third area listed above and also contain some significant measures affecting the second area. There are two reasons for this emphasis: operational pollution accounts for 80 percent of the oil inputs to the oceans from tankers, and international standards which will greatly reduce operational pollution, as well as contribute significantly to the reduction of accidental oil outflows, have been elaborated and proposed for worldwide adoption in the 1973 Marine Pollution Convention.

The alternatives to the proposed action in this case are other forms the regulations might have taken--requirements that might have been omitted, added, or changed. The basis for comparison of these alternatives is the rules described in Section 2, the environmental impact of which is assessed in Section 3. These rules are based on the standards contained in the 1973 Marine Pollution Convention.

4.2 Summary of Alternatives Considered

Here is a list of the alternatives considered. (The reasons why these alternatives were not adopted are discussed on the following pages):

A. Publish no additional regulations. (No Action)

B. Publish regulations less stringent than those proposed. These could include:

1. Less strict discharge criteria which would allow more oil to be discharged overboard from tank cleaning and ballasting operations.

2. Discharge restrictions allowing discharges into waters less than 50 miles from U. S. coastlines.

3. Regulations not requiring segregated ballast on new tankers over 70,000 DWT.

C. Publish regulations more stringent than those proposed. These could include:

1. Regulations prohibiting any discharge of oily mixtures to the sea.

2. Regulations allowing oily mixtures to be discharged but limiting the concentration and total amount of oil discharged to quantities smaller than those in the proposed rules.

3. Regulations requiring segregated ballast

   a. on tankers smaller than 70,000 DWT

   b. on existing tankers

   c. be located so as to reduce cargo loss following collision, grounding, or other accident (specifically, in double bottoms)

4. Regulations requiring double bottoms.

5. Regulations requiring smaller tank size limits.

6. Regulations requiring various construction features and equipment intended to improve vessel maneuvering and stopping ability. These include:

   a. increased astern horsepower (greater backing power)

   b. twin screws and twin rudders

   c. controllable pitch propeller(s)

   d. bow thruster, or bow and stern thrusters

e. more rudder area

f. faster rudder turning rate

g. flapped rudder

h. rotating cylinder rudder

i. auxiliary braking devices (flaps, parachutes, etc.)

7. Regulations similar to those contained in the June 28, 1974, advance notice of proposed rulemaking on Marine Traffic Requirements, including regulations on navigation equipment.

8. Regulations requiring cargo tank inerting systems.

9. Regulations requiring posting of vessel maneuvering information in the pilothouse of all vessels.

10. Regulations requiring improved radar training for ship's officers.

11. Regulations setting improved standards for training and watchkeeping.

D. Reduction of oil consumption or reduction of oil imports.

E. Use of a different mode of transportation for oil.

4.3 Reasons Why Alternatives Were Rejected

The alternative of issuing no additional regulations was rejected since Title II of the Ports and Waterways Safety Act requires the Coast Guard to publish proposed rules and regulations for minimum standards of tank vessel design, construction, alteration and repair for the purpose of protecting the marine environment. In addition, failure to issue rules would be inconsistent with the position the United States took at the 1973 Marine Pollution Conference and the provisions of the resulting international agreement.

The second alternative, that of publishing regulations less stringent than those that have been proposed, includes several sub-alternatives:

1. Less strict discharge criteria which would allow more oil to be discharged overboard from tank cleaning and ballasting operations,

2. Discharge restrictions allowing discharges of oily mixtures into waters less than 50 miles from U. S. coastlines, and

3. Regulations not requiring segregated ballast on new tankers over 70,000 DWT.

These sub-alternatives and, indeed, all courses of action involving regulations less stringent than the proposed regulations and the standards

contained in the 1973 Marine Pollution Convention (which the proposed regulations embody), have been rejected for the following reasons:

They are inconsistent with the standards contained in the 1973 Marine Pollution Convention; they are less desirable from an environmental viewpoint since they would not restrict the amount of oil entering the world's oceans to as great an extent as the proposed rules; and technology is available to do better in terms of reduction of oil inputs from operational sources (i.e., higher standards are practicable in terms of cost and technical feasibility).

The need for regulations applicable to U. S. tankers in domestic trade to be consistent with the 1973 Marine Pollution Convention is discussed on pages 4-10 of this environmental impact statement. The matter of setting discharge criteria is discussed further in the following paragraphs on more stringent regulations. No detailed assessment of added environmental damage which might result from regulations allowing discharges within 50 miles of U. S. coastlines (but outside U. S. territorial waters) has been made, but the Coast Guard believes that the validity of prohibiting discharges from tanker cargo spaces into waters of this zone is adequately supported by previous international agreements. Segregated ballast was recognized by the 1973 Marine Pollution Conference as an effective means of reducing the amount of oily mixtures created as a result of tank ballasting, particularly on crude oil carriers which make up the fleet of ships over 70,000 DWT.

More Stringent Regulations

The alternative of publishing regulations more stringent than those proposed is the most complicated of all the alternatives considered because of all the possible features or measures which might have been included in the regulations. A number of the sub-alternatives considered have been rejected for purposes of this rulemaking, but will probably be included in the full body of the rules and regulations that will ultimately be required to fully implement the Ports and Waterways Safety Act of 1972. Some of these features or measures have already started through the rulemaking process and others are still under development by the Coast Guard. Reasons for the rejection of these features or measures for purposes of this rulemaking are discussed in the following paragraphs, with cross-references to additional discussion elsewhere in this impact statement where necessary.

Prohibit Any Discharge of An Oily Mixture

In order to reduce operational outflows, regulations prohibiting any discharge of an oily mixture to the sea from a tank vessel's cargo spaces might be published. This prohibition might be achieved by requiring tank vessels to:

a. wash tanks at the unloading point and transfer the tank washings to a reception facility prior to taking on clean ballast for the return voyage; or

b. retain all dirty ballast and tank washings on board the vessel and then transfer them to a reception facility; or

c. carry segregated ballast and retain on board all tank washings, dirty ballast from fuel oil tanks, and bilge water containing lubricating and fuel oil drained or leaked from machinery until they can be transferred to a reception facility.

The concept of a total prohibition against discharges of oily mixtures into the sea and these means of achieving such a goal have been rejected for the following reasons: it is inconsistent with the standards established by the 1973 Marine Pollution Convention; it would create greater shore reception facility problems than we already have with the proposed regulations; it would involve additional time delays for tankers; and it sets a standard that will be impractical for application to vessels other than tankers.

The need for regulations applicable to U. S. tankers in domestic trade to be consistent with the standards established by the 1973 Marine Pollution Convention is discussed on pages 4-10 of this environmental impact statement.

The proposed regulations will increase the need for shoreside oily residue reception and treatment facilities, particularly where cargoes not amenable to load-on-top procedures are being transported. Questions concerning the availability and environmental effects of shore reception facilities are discussed on page 47. The procedures involving washing tanks prior to departure and retaining all dirty ballast until end of voyage, procedures a. and b. above, would greatly increase the need for shore reception facilities, since much larger amounts of washwater and dirty ballast would have to be treated. Both of these alternatives would, then, only make an already serious situation worse.

Neglecting delays due to port congestion around reception facilities, procedures a. and b. would also involve additional vessel voyage time--about 10 percent more for a., and a slightly smaller amount for b. These delays would be reflected in increased costs and numbers of ships needed to provide the same throughout capacity.

If regulations prohibiting the discharge of an oily mixture to the sea from tank vessels were published, then this same restriction would, in the Coast Guard's view, have to be applied to all other seagoing vessels. (Note that the requirements of the 1973 Marine Pollution Convention apply to all vessels, not just tank vessels. Also, refer to pages 8-9 for a discussion of grounds for making distinctions in the regulations applicable to particular classes or groups of vessels.) All bilge water would then have to be retained on board for disposal at a shoreside reception facility. This would not present a serious problem on tank vessels where tankage used for cargo slops could probably also accommodate bilge water generated, but other types of

vessels would be required to install large storage tanks at substantial cost. A requirement to provide storage tanks for all of a ship's bilgewater is both impractical and unnecessary in the Coast Guard's view.

Although prohibiting any discharge of oily mixtures, or a "zero discharge standard" as it is sometimes called, has been rejected as an alternative for purposes of these regulations applicable to all tank vessels in domestic trade, such a standard will be applied to vessels loading oil at the Alaska pipeline terminal at Valdez. The permit agreement between the Department of the Interior and Alyeska Pipeline Corporation stipulates that ships loading there will discharge all oily residues ashore and that shore reception facilities will be provided. This satisfies demands for such a standard on this trade without influencing international acceptance of the Marine Pollution Convention due to unilateral U. S. action.

Allow Some Discharge But Not As Much As Proposed

Another possibility for reducing operational outflow from levels permitted by the proposed regulations would be to publish regulations allowing oily mixtures to be discharged, but limiting the concentration and total amounts of oil discharged to quantities smaller than those in the proposed rules. This alternative has been rejected for the following reasons: Such action is not consistent with the standards of the 1973 Marine Pollution Convention; it involves significant problems in arriving at permissible discharge quantities; it is not practical at the present stage of technological development; and it would involve considerable time delay while improved shipboard separation and monitoring techniques were developed.

The need for regulations applicable to U. S. tankers in domestic trade to be consistent with the standards established by the 1973 Marine Pollution Convention is discussed on pages 4-10 of this environmental impact statement.

The discharge criteria contained in the proposed regulations are identical to those in the 1973 Marine Pollution Convention. The values set by the Conference represent consensus of expert opinion, based on shipboard tests, of results that can be achieved by diligent use of load-on-top techniques with the separation and monitoring techniques currently available. At a discharge rate of 60 liters of oil per mile, whatever sheen is created by oil on the water disappears a short distance behind the ship. Oil-in-water concentrations left in the wake of a ship discharging such a mixture at least 50 miles offshore are well below the levels at which environmental damage has been observed. (See conclusions of NAS report Petroleum in the Marine Environment starting on page 235 of this impact statement.) The discharge criteria set forth in the regulations represent the most effective pollution control performance standard achievable with load-on-top techniques presently available.

It would be much more satisfying if, as the Center for Law and Social Policy suggested in commenting on the draft EIS, any damage to the marine environment produced at a 60 liters per mile discharge rate could be set

forth and assessed and discharge criteria established on the basis of (a) conclusive evidence showing it is not technologically feasible to reduce discharges below these levels and (b) conclusive evidence that discharges at such levels are not harmful to the marine environment.[19b] Unfortunately, as with many other environmental issues, conclusive evidence is not available and decisions must be made in the face of some uncertainty. Work done in preparation for the 1973 Marine Pollution Conference and deliberations at the Conference support the belief that the discharge criteria in the Convention and the proposed regulations represent the limits of what is technologically feasible today and in the near future. The report, Petroleum in the Marine Environment (reference 5), supports the belief that discharges at the 60 liters per mile level will not significantly damage the marine environment. But in both cases the evidence is far from "conclusive."

In view of this, the Coast Guard rejects as impractical the notion of setting discharge criteria for purposes of these regulations which are more stringent than those in the 1973 Marine Pollution Convention. The Coast Guard also considers a total prohibition against any discharge of an oily mixture to be equally impractical.

Additional Requirements for Segregated Ballast

The Coast Guard adopted for purposes of these regulations a requirement for segregated ballast on new tankers over 70,000 DWT. Several additional segregated ballast measures were considered and rejected. These measures are: requiring segregated ballast on new tankers smaller than 70,000 DWT (in addition to requiring it on new tankers over 70,000 DWT as the proposed regulations do); requiring existing tankers be modified to provide segregated ballast spaces; and requiring that segregated ballast be located so as to reduce cargo loss following collision, grounding or other accident (and, specifically, in double bottoms).

The first of these, requiring segregated ballast on tankers smaller than 70,000 DWT, has been rejected because it is not included in the standards contained in the 1973 Marine Pollution Convention, and because it would not be an effective pollution prevention measure on smaller tank vessels because most of these vessels carry petroleum products rather than crude oil and must wash tanks for cargo purity reasons rather than to provide space for clean ballast.

The need for regulations applicable to U. S. tankers in domestic trade to be consistent with the standards established by the 1973 Marine Pollution Convention is discussed on pages 4-10 of this environmental impact statement.

Tankers clean cargo tanks for several reasons:

a. to provide space for clean ballast,

b. to remove sediment deposited by previous cargoes,

c. to prepare a tank for loading where maintaining the purity of the next cargo is very important, and

[19b] See pages 149, 176, and 177 of this impact statement.

d. to make a tank safe for internal inspection and repair work.

Segregated ballast will eliminate the need to wash cargo tanks to provide space for clean ballast, but it does not affect the need to clean tanks for the other purposes mentioned above. All tankers have to clean tanks periodically for internal inspection and repairs. Crude oil carriers have to do some cleaning to control sediment buildup, but generally they do not have to worry about cleaning to insure purity of the next cargo. Most product carriers are forced to clean all of their tanks on the ballast leg of each voyage to insure their next cargo is not contaminated by remnants of their last cargo. While segregated ballast will have a significant impact on operational outflows from crude oil carriers (most of which are larger than 70,000 DWT), it would not significantly reduce the amount of tank cleaning and the resulting operational outflows from produce carriers (all of which are under 70,000 DWT) since the oily mixtures are created by cargo purity washing needs, rather than clean ballast considerations.

The second segregated ballast measure, requiring existing tankers be modified to provide segregated ballast spaces, has been rejected for purposes of this rulemaking on the following grounds: It is not required by international standards contained in the 1973 Marine Pollution Convention; it must be done on a worldwide basis if adverse effects on the competitive standing of U. S. vessels are to be avoided; and there is a higher priority need to get the principle of segregated ballast for new vessels accepted worldwide before trying to extend segregated ballast requirements to existing vessels. The need for regulations applicable to U. S. tankers in domestic trade to be consistent with the standards established by the 1973 Marine Pollution Convention is discussed on pages 4-10 of this environmental impact statement. At this point, the Coast Guard's greatest concern is to get the Convention requirement for segregated ballast on new vessels accepted internationally and into force. Once that goal is realized, consideration can be given to extending segregated ballast requirements to existing vessels.

The third segregated ballast measure, requiring that segregated ballast be located so as to reduce cargo loss following collision, grounding, or other accident (and, specifically, in double bottoms), has been at least partially incorporated into the final rules, although double bottoms are not required. Requirements for location of segregated ballast are discussed on page 19 and in Appendix C, starting on page 241. The alternative of specifically requiring double bottoms is discussed in the following paragraphs.

<u>Measures to Reduce Accidents and Cargo Loss Following Accidents</u>

As noted on page 58, it has not been possible to develop a comprehensive set of rules covering all aspects of the problem of oil pollution from tankers in the period since the Ports and Waterways Safety Act became law. The proposed rules, the first step toward full implementation of the Act, concentrate primarily on operational pollution because 80 percent of the oil inputs to the oceans from tankers result from routine operations, and because international standards which will greatly reduce operational pollution have been

elaborated and proposed for worldwide adoption. On the other hand, the problem of accidental pollution, which has received much more public attention, accounts for only 15 percent of oil inputs from tankers but is more difficult to solve. The remaining measures to be discussed as part of the alternative of publishing regulations more stringent than those proposed have to do with standards proposed to reduce the possibility of an accident or to reduce cargo loss following an accident.

Before one can evaluate the effectiveness of various measures intended to avoid accidents or to mitigate the resulting oil outflows, it is necessary to have a basic understanding of the tanker accident phenomenon and the factors influencing accident occurrence and effects. The discussion on pages 62-81 provides background on tanker accidents and many of the vessel equipment and features discussed in the following paragraphs. The reader should refer to the expanded discussion where indicated.

Double Bottoms[19c]

A requirement that new U. S. tank vessels intended for use in domestic trade be constructed with a double bottom within the cargo space has been rejected for purposes of these regulations for the following reasons: Such a requirement is not included in the 1973 Marine Pollution Convention, and double bottoms would be ineffective in reducing cargo loss during accidents other than groundings. The need for regulations applicable to U. S. tankers in domestic trade to be consistent with the standards contained in the 1973 Marine Pollution Convention is discussed on pages 4-10 of this environmental impact statement. Frequency and seriousness of various types of accidents, and double bottom cost, effectiveness, and disadvantages are discussed on pages 72-77. No particular type of vessel damage so dominates accidental outflow that a single design solution should, in the Coast Guard's view, be stipulated by law or regulation.

Smaller Tank Size Limits

A requirement that new U. S. tank vessels intended for use in domestic trade be built with tank size limits smaller than those included in the proposed rules (described on page 21) was rejected for the following reasons: Such a requirement would not be consistent with the international standards in the 1973 Marine Pollution Convention; any reduction in accidental outflow achieved would be offset by increased operational pollution; and piping system complexity, vessel cost, chances of overfilling of tanks, and vessel loading times would all be increased. The need for regulations applicable to U. S. tank vessels in domestic trade to be consistent with the requirements of the 1973 Marine Pollution Convention is discussed on pages 4-10. The increase of operational pollution due to increased tank surface area and effects of increased piping system complexity, vessel cost, risk of overfilling, and vessel loading times are discussed on page 77.

[19c] For a description of a double bottom and discussion of why they are used on various types of ships refer to page 196 of this EIS.

Improvements in Maneuvering and Stopping Ability

Requirements for various construction features and equipment intended to improve vessel maneuvering and stopping ability (and thus reduce the possibility of an accident) have been rejected as part of these proposed regulations for the following reasons: Such requirements are not included in the international standards in the 1973 Marine Pollution Convention; there are unresolved questions concerning their effectiveness in reducing accidents which must be cleared up before regulations are published; and the features and equipment available improve maneuvering and stopping ability of large tankers only marginally. The need for regulations applicable to U. S. tank vessels in domestic trade to be consistent with the requirements of the 1973 Marine Pollution Convention is discussed on pages 4-10. Effectiveness of various construction features and equipment in improving maneuvering and stopping ability and in reducing accidents is discussed on pages 64-71. The primary reason for rejecting these requirements is the absence of any evidence that the improvements in maneuvering and stopping ability which these features and equipment would provide for large tankers would materially reduce the possibility of collision, grounding, or other accident.

Marine Traffic Requirements

While it has not been possible for the Coast Guard to develop a comprehensive set of rules covering all aspects of the tanker oil pollution problem in the period since the Ports and Waterways Safety Act became law, one thing that a review of accident reports has made clear is that insuring adequate human performance is most important in avoiding tanker accidents. While much remains to be learned about why humans sometimes fail to perform adequately and about the interrelationships between man and the other system components, the Coast Guard has concluded that it is important to act now on what has been learned in an attempt to bring about improved human performance. An advance notice of proposed rulemaking entitled "Marine Traffic Requirements" was therefore published along with the proposed regulations for tank vessels in domestic trade on June 28, 1974. The notice indicated that the Coast Guard was considering requirements for improved operating practices and mandatory navigation equipment, and solicited comment from the public. Requirements incorporating provisions contained in the advance notice were rejected for purposes of these regulations only because more work remains to be done by the Coast Guard to prepare proposed rules which effectively achieve the objectives set out in the advance notice.

Inerting Systems

The rules proposed on June 28, 1974, contained no requirements for cargo tank inerting systems. Proposed rules for tank vessel safety improvements, which include cargo tank inerting systems on crude oil tankers over 100,000 DWT and on combination carriers (bulk/oil and ore/oil vessels) over 50,000 DWT, were subsequently published in the April 21, 1975, Federal Register. The primary benefits of inerting are safety benefits, since only a small fraction of oil inputs to the oceans results from cargo tank explosions. (Refer to page 37.)

Posting of Vessel Maneuvering Information

One area of inquiry concerning efforts to improve human performance in piloting large tankers concerns the information that a vessel's pilot or master needs to have to safety direct the vessel's movements. Requirements that certain information on the maneuvering and stopping characteristics of all ships over 1,600 gross tons (not just tankships) were published in the January 15, 1975, Federal Register. While not a part of these rules, requirements for posting of vessel maneuvering information are a part of the Coast Guard's overall program for implementing the Ports and Waterways Safety Act.

Improved Radar Training

Another measure which could have an effect on accidental oil outflows is a requirement for improved training for ship's officers in the use of radar in collision avoidance. Such a requirement was rejected for purposes of these regulations because additional work is needed before regulations are issued. The Coast Guard is currently working with the Maritime Administration and various maritime training schools and institutes to make improved courses in the use of radar available to a greater number of mariners. The Coast Guard has also moved to substitute approved radar school courses for the plotting portion of the Coast Guard examination given for original licenses, license renewal, or upgrading of a license. Such courses have proven more effective than pen-and-pencil exams. Providing proper training in the use of radar in avoiding accidents is an important step toward reducing the possibility of collision and grounding.

Improved Standards for Training and Watchkeeping

Regulations setting improved standards for training and watchkeeping were rejected as an alternative for purposes of these regulations because additional progress toward achieving international agreement on standards is needed before regulations can be proposed. In early 1970, an IMCO working group reported:

> ". . . that in view of the continuing alarming rise in maritime casualties and pollution, it is necessary for urgent action to be taken aimed at strengthening and improving standards of training and professional qualifications of mariners as a means of securing better guarantees of safety at sea and protection of the marine environment."

Since 1971 the IMCO Sub-Committee on Standards of Training and Watchkeeping has been working with U. S. participation to prepare documents dealing with personnel standards and qualifications which can form the basis for an international conference on the subject, tentatively scheduled for 1977. Most of the world's merchant fleet sails under foreign flags. This means the United States does not have direct control over standards for crew training and watchkeeping on these ships. It is most important, therefore, that the problems of improving training and professional qualifications, particularly on foreign vessels where standards may not be as high as on U. S. ships, be approached on an international basis through IMCO.

Reduction of Oil Consumption or Reduction of Oil Imports

Both of these are being discussed as proposed national goals for economic, political, and social, as well as environmental reasons. Neither of these can be considered serious alternatives to the pollution prevention regulations under consideration, although they will have an impact on the number and size of tankers needed to meet transportation needs on construction of new tankers. Recent reduction in demand for transportation of crude oil, along with delivery of new tonnage, have led to the availability of surplus tonnage, collapse of the tanker market, idle ships, and cancellation of orders for new tonnage. Such conditions mean owners must reduce operating costs as much as possible. It also means marginally profitable vessels will be laid up until market conditions improve. Therefore, these cannot be considered realistic alternatives to the proposed rules.

Use Different Mode of Transportation for Oil

The use of some alternate mode of transportation for oil cannot be considered a serious alternative to the pollution prevention regulations. Tankers have evolved to fill a need for transportation that cannot be met by other modes.

4.4 Discussion of Reasons for Rejection of Alternatives

Tanker Accidents

Section 3.2 outlined the sources of marine pollution from tanker accidents and estimated (Table 4) how much oil is deposited annually from accidents. A tanker accident, like any accident, can be defined as an undesirable and unexpected happening. Because of the adverse consequences of accidents, personnel involved with any activity, including tanker operation, generally follow methods and procedures which eliminate the causes leading to accidents. This results in an accident being a rare happening which is almost always a surprise to the people involved. Since people usually eliminate the causes leading to an accident, one would expect that when an accident did occur, the particular cause or causes would be easy to identify. Unfortunately, this is not always true. Infrequent occurrence of accidents, their surprising nature, and the lack of knowledge of why humans fail, make accidents difficult to analyze. Accident analysis always occurs after the unexpected event and is often complicated by emotional and legal problems. It is, therefore, important not to over-simplify accidents by attributing them to a single, simply-stated cause, and to recognize that when dealing with them, one is faced with rare events which almost always involve some human failings and which are difficult to analyze.

For discussion purposes, tanker accidents shown in Table 4 can be grouped into four categories: (1) those resulting from misdirected motion of the ship -- collisions, rammings and groundings; (2) structural failures; (3) fires and explosions; and (4) breakdowns.

Collisions, Rammings, and Groundings

Collision, ramming and grounding accidents occur when the normal sequence of vessel navigation is interrupted or otherwise becomes inadequate for the circumstances. The sequence of events leading to a casualty are:

1. A problem arises;

2. The shipboard personnel recognize that a problem exists;

3. The problem is "sized up" and alternative courses of action are evaluated;

4. Action is taken to control the problem (usually engine commands and/or rudder commands, although other actions, like dropping an anchor, are possible);

5. The vessel responds to the action;

6. Shipboard personnel sense the vessel response, re-evaluate the problem and take further action if necessary; and

7. Either the problem is resolved or a collision, ramming or grounding accident occurs.

If the accident is avoided, which is generally the case, no further action is required. However, if the accident occurs, then the personnel involved must take further action in order to keep the consequences to a minimum. It follows that there are two avenues which can be taken in order to reduce accidental pollution from tankers: (1) prevention before the accident occurs and (2) mitigation of the consequences after the accident occurs.

Preventive Measures

Preventive and mitigating measures will both be discussed; however, it should be noted that in overall system safety, preventive measures are far more effective than mitigating measures. Preventive measures which can be taken to reduce the risk of a ship motion accident must be discussed in terms of the seven-step sequence leading to a casualty just discussed. Examination of that sequence points out that much more is involved than the ability of vessels to respond to engine and rudder commands. Because of this, the Coast Guard feels it is necessary to expand on the terms "maneuverability" and "stopping ability" contained in 46 U.S.C. 391a(7)(A). In order to respond to the intent of that law which is to "reduce the possibility of collision, grounding or other accident," the Coast Guard has chosen to define the term controllability, which is the ability of a vessel to successfully navigate from a certain specified location to another specified location. Controllability is composed of the following aspects:

a. Maneuverability of a specific ship; stopping ability is included within the category of "maneuverability."

b. The environment in which the specific ship is operating, including considerations of time of day, visibility, wind, current, and stage of tide.

c. The constraints imposed by the geographic location within which the ship is operating, including considerations of depth of water, channel width, channel configuration, channel obstructions such as shoals, bridges, docks, etc., vessel traffic density, and availability of external aids to navigation.

d. The human element as represented by the specific vessel personnel who must utilize their skills to evaluate the interactions of maneuverability, environment and geographic location and react correctly to the evaluation.

By using this definition of controllability, not only is the inherent maneuvering capability of a vessel considered, but also the locations where the ship operates, the surrounding environmental conditions, and the people operating the ship (probably the most important element). Each of these aspects by themselves deserve attention in evaluating accident preventive measures. However, concentrating efforts on one aspect without taking into account the others or their interrelationships will not be very productive.

The Coast Guard recognizes the importance of the interrelationships and is proceeding to evaluate and understand all the aspects of controllability and their interrelation. Our efforts to date have resulted in some preventive measures: Regulations for the posting of maneuvering information on the bridge, proposed regulations for navigation equipment, improved radar training for bridge personnel, IMCO Standards of Training and Watchkeeping, and regulations allowing the Captain of the Port to temporarily control traffic in areas determined to be especially hazardous. Preventive measures like these have a favorable impact on the first four steps of the seven-step sequence leading to a casualty. Still these regulations offer only partial solutions because the complexity of the problem makes it difficult to determine acceptable criteria against which vessel design and operations, channel configuration, traffic density, and environmental factors can be weighed. Simply stated, the problem is tough and we don't know all the answers.

Maneuverability

One aspect of controllability -- maneuverability -- has received more attention than the other aspects. Most comments received stated that the regulations should require improved maneuverability in tankships by requiring such design features as twin screws, twin rudders and bow thrusters. However, it is important to see that design features like these will affect only step 5 (vessel response) of the seven-step sequence leading to a casualty.

Stopping

Stopping ability of a ship is measured by both the distance and time required to stop from a given speed. The main factors which affect stopping are:

a. Speed of ship at beginning of stopping maneuver.

b. Amount of reverse thrust available for stopping, which is chiefly a function of the installed horsepower, type of propulsion system, and type and size of propeller.

c. Time lag in applying reverse thrust.

d. Amount of hydrodynamic resistance (drag) of the ship's hull.

e. Mass of ship and cargo.

To improve stopping ability of tankers it is necessary to make improvement in any or all the above areas. Obviously, reducing ahead speeds will

result in shorter stopping distances -- a fact which shouldn't be taken lightly.

Compared to other forms of transportation, ships have a very low resistance to motion. The drag force (expressed as a fraction of each vehicle's weight force) of several vehicles may be compared as follows:

Automobile	0.07 - 0.1, depending on speed
Rail car	0.05
Merchant ship	0.01 - 0.001
Large tanker	0.0005

If a large tanker were capable of moving on land, it would roll on a grade too small to be perceptible. (14) This is, of course, one of the things that has led to use of large tankers -- they move easily through the water and are very efficient (and therefore inexpensive) users of energy.

To overcome resistance and move the ship through the water a maximum propeller thrust of only a small fraction of the weight force is all that is required. For stopping the tanker considered above the maximum combined reverse thrust and hull resistance forces are about one thousandth of the vessels weight, providing decelerations of .001 g, or very roughly a knot per minute. Trials of such ships confirm 15 or 20 minutes is required to come to a stop from full speed. (14) But, such sluggish behavior is inherent in a low-drag vehicle and is not the result of any avoidable shortcomings in design.

Measures which have been frequently discussed by the public to improve stopping are increasing astern horsepower, installing a controllable pitch propeller and installing auxiliary braking devices such as brake flaps and water parachutes.

Astern horsepower, which is usually some fraction of the design horsepower, affects the reverse thrust available for stopping. Design horsepower for a tanker is determined by requirements for the steady state steaming condition which constitutes a majority of a ship's life. In addition to safety considerations, other primary concerns of an owner when specifying the type of propulsion plant for his ship are high reliability, ease of maintenance and efficient use of fuel. From the standpoint of overall engineering efficiency, the propulsion system in a supertanker is very effective. The fact that the system has been optimized for steady steaming does not mean that the ship is unsafe from a maneuvering viewpoint.

Increasing astern horsepower will decrease stopping distance, but not very effectively. For example, providing <u>double</u> the normally installed astern horsepower would decrease stopping distance for a 250,000 DWT tanker traveling at 16 knots from 15 ship lengths to 12 ship lengths (a decrease of approximately 20 percent). A similar reduction in stopping distance can be achieved by slowing the ship from 16 knots to 13 knots in anticipation of a possible need to stop, such as when approaching more confined waters or a maneuvering situation.

A controllable-pitch propeller (CPP) would also shorten stopping distance, but again not to a large degree. Estimations based on manufacturers' reports are that CPP's would reduce the stopping distance of a standard 250,000 DWT tanker by 30 percent from 15 ship lengths to 10.5 ship lengths. A similar reduction in stopping distance can be achieved by reducing speed from 16 knots to 12 knots.

Auxiliary braking devices such as water parachutes and brake flaps act to increase the hydrodynamic resistance of the hull and thereby supply a retarding force to vessel forward motion. Since these devices depend on hydrodynamic resistance, which is roughly proportional to the square of ship's speed, they are relatively ineffective for ship stopping from slow speeds. Doubling the hull resistance on the standard 250,000 DWT tanker would decrease the stopping distance from 16 knots by approximately 20 percent from 15 ship lengths to 12 ship lengths. Such an increase in hull resistance at 16 knots could be achieved by installing one 10 feet wide by 30 feet high flap on each side of the ship or by installing 12, ten feet in diameter, water parachutes, six per side.

This component of maneuverability has been discussed more than any other. Newspaper editorials, magazine articles, books and general public comment have all focused on the inadequate stopping ability of tank vessels. It is less clear, however, that stopping ability is, in fact, inadequate or that poor stopping ability has been a primary contributing factor to accidents. In the more than eight years since the first 200,000 DWT tanker (IDEMITSU MARU 1966) was put into service, the Coast Guard has not been able to document one case where inadequate stopping of a large tanker was a major contributing cause in a marine accident.

In comparison to smaller ships a large tanker requires more time and more distance to stop because of the tremendous mass of the vessel and its cargo. As already mentioned, the stopping distance of a standard 250,000 DWT tanker from service speed is approximately 15 ship lengths and there is no means by which this distance could be drastically reduced so that the ship could stop on a dime. Furthermore, there is no need for such a capability.

Those situations where a ship would be called upon to stop from full speed are extremely rare. In the open ocean where full speed is used, large tankers can readily detect the presence of other shipping and evade collisions with minor deviations from course. In an emergency, the most effective evasive maneuver is to put the ship into a turn assuming adequate room and water depth. The reason for the effectiveness of this maneuver is that the maximum distance travelled in the direction the vessel was originally moving at full speed, if full rudder is used is approximately 3 ship lengths in comparison to the 15 ship lengths required to stop.

In more confined waters and in harbors vessel speeds are reduced which results in shorter stopping distance. The average 250,000 DWT tanker will stop in less than 4 ship lengths when travelling at 6 knots. Also, in such waters and in and around offshore loading systems, large tankers have been assisted in their maneuvering, including stopping, by tugs in the same fashion as are other large ships (i.e., aircraft carriers, passenger liners and high speed container ships).

Turning Ability

The second aspect of vessel maneuverability -- turning ability -- is not discussed nearly as much as stopping ability, but is equally important. At operating speeds the turning radius of a specific vessel is the accepted measure of a vessel's turning ability. Turning radius is a function of the vessel shape, length-to-beam ratio, and rudder forces. Tank vessels, as presently designed, have excellent turning ability mainly because of their full shape and low length-to-beam ratio. The turning radius for a 250,000 DWT tanker is approximately 1.3 ship lengths while that of a much smaller and finer-lined Mariner class cargo ship is approximately 2.2 ship lengths. Possible design features, which would affect turning ability, are increasing rudder area, twin screws, bow and stern thrusters, faster rudder rate, flapped rudders and rotating cylinder rudders.

Installation of twin rudders would make it possible to increase the rudder area for a particular ship, thereby increasing the turning ability, provided twin screws were also installed so that the rudders would work in the propeller race. An increase of 60 percent in the presently designed rudder area for a standard 250,000 tanker would increase an already excellent turning ability by only 10 percent, thereby reducing the turning radius to about 1.2 ship lengths.

Turning ability at zero or very slow speeds can be substantially increased by installation of bow and stern thrusters. Generally these devices are ineffective at vessel speeds greater than 6 knots. Improvement in low speed maneuverability would help reduce those accidents in and around berths and piers -- most of which are rammings. However, of the one million tons of oil pollution from worldwide tanker accidents in the past five years, only 14,000 tons or 1.4 percent resulted from ramming casualties. Effectiveness of thrusters in reducing ramming casualties is not known. A further consideration in this area is the cross relationship of the human element and vessel design relating to bow and stern thrusters. At the Netherlands Ship Model Basin, where experiments of tanker maneuvers are conducted on a shiphhandling simulator, ship performance with the thrusters was observed to be worse than the standard ship not so equipped until after the pilots became practiced in using the new equipment on the specific test model.

Twin screws would also have some positive effect on the zero or very slow speed turning ability of tankers. By running one screw ahead and the other astern, a twisting moment is applied to the ship which will assist in turning the ship. However, this turning assist is not nearly as large as that for thrusters and is therefore less effective. Increased rudder rate has a very slight effect on turning ability. Increasing rudder rate on a standard 250,000 DWT tanker by 50 percent would increase turning ability by approximately 1-2 percent. Alternate rudder designs such as flapped rudders or the rotating cylinder rudders are promising innovations which could increase turning ability. However, these systems are still in the developmental stage and have never been used on large ships.

Course Changing

Course changing ability is closely related to turning ability, but differs in that it indicates the ability of a vessel to initiate or check a turn at operating speed. This aspect of maneuvering is measured by a standard maneuver known as the zig-zag or "Z-maneuver." Vessel design factors which have a major influence on course changing ability are mass, length, hull form, rudder area and rate of rudder deflection. Since mass, length, and hull form are generally fixed for large tankers, improvement in course changing ability would need to come from either increased rudder area or increased rate of rudder deflection. Again using a standard 250,000 DWT tanker as a measure, an increase in rudder area by 60 percent would improve course changing ability as measured by the "Z-maneuver" by approximately 10 percent. Increasing rudder rate by 100 percent would increase course changing ability by less than 10 percent.

Course Keeping Ability

Course keeping ability, sometimes called course stability, refers to the ability of a vessel to steer a straight course with minimum rudder action. One of the concerns about large tanker maneuverability has been the lack of course stability. Generally there is a misunderstanding regarding course stability. A clear distinction must be made between a dynamically stable ship and a directionally stable ship. A vessel is considered dynamically stable on a straight course if, when disturbed from her steady motion, she will soon resume that same motion along a slightly shifted path without any correcting rudder being applied. A steered ship is said to be directionally stable if sustained oscillations of the ship's motions or if the rudder motions needed to compensate the ship's heading errors are sufficiently small to be considered tolerable. Most full-form ships, regardless of size, cannot achieve dynamic stability, but can achieve an acceptable degree of directional stability. It is most desirable for a commercial vessel to possess directional stability. Loss of directional stability results in economic penalties due to increased voyage time and increased fuel consumption. Therefore, vessel owners have incentive to insure adequate course stability through design. Design factors which have a major effect on course keeping ability are vessel shape, length-to-beam ratio, rudder area and steering control system response parameters.

Design Changes to Improve Maneuverability

At this point it is evident that several design changes can be made to tank vessels in order to improve their inherent maneuverability. However, it should also be clear that none of the changes could be expected to improve the maneuverability of large tankships by more than 30 percent. The fact is that, because of their size, large tankers cannot be made to maneuver as readily as smaller ships. This realization is not surprising when one compares large ship operations with an analogous situation on the highways where a 60,000 pound multi-axle truck is much less maneuverable (in terms of stopping and turning ability) than a 3000 pound automobile.

Realizing that inherent maneuverability of tank vessels can be improved, the questions to be asked are:

a. Is there a need to improve the maneuverability?

b. If the maneuverability is increased, what effect will this have on accident reduction?

One indication of a need to improve large tank vessel maneuverability would be if accident data indicated that large tankers were experiencing collision, ramming and grounding accidents at a rate greater than smaller vessels. Intuitive feeling is that large tankers should have a higher accident rate. However, this intuitive feeling is not supported by accident information. Worldwide accident figures (8) indicate that during the period 1969-1973, tankers over 150,000 DWT were involved in collisions, rammings, and groundings at the rate of 0.0465 involvements per ship year. (This means that based on the past five years of accident data, one could expect 4.65 percent of those tankers greater than 150,000 DWT to have a collision, a ramming, or a grounding each year.) The average frequency for all tankers greater than 3,000 DWT is 0.0958. The group of tankers having the highest frequency of accidents are those in the 20,000 - 40,000 DWT range where their frequency is 0.1265.

Another indication of a need to improve large tank vessel maneuverability would be if the analyses of individual collision, grounding, and ramming accidents showed that a lack of maneuverability was a major contributing factory in these accidents. To examine for this, Coast Guard casualty information for years 1972 through 1974 was sorted by the recorded cause of the accident. These sorts showed that there were 1206 vessels greater than 10,000 gross tons involved in collision, ramming, and grounding accidents. Of these 1206, only 80 (or 6.6 percent) could be attributed to inadequate vessel maneuverability, and most of these were the result of a breakdown of the installed propulsion and maneuvering system. In addition to sorting all casualties by cause, individual accident records have been reviewed to see if the maneuvering design of the ships involved was inadequate. Results of the cause sort and individual accident investigations show that more than 65 percent of the accidents were caused in whole, or in part, by "inadequate human performance." Only 6 percent were attributed to inadequate vessel maneuvering capabilities. These percentages do not change appreciably with vessel size.

None of the casualty analyses conducted to date demonstrate a need for improved maneuverability of large tankships. While no need has been established, the Coast Guard does not consider its work in casualty analysis complete. As more is learned about the complex man-machine system which controls the movement of a ship from one port to another, the Coast Guard will be capable of analyzing individual casualties with new insights. In addition, as more is known of traffic patterns and tanker operations, worldwide tanker casualty information could be analyzed using various measures of exposure and risk, such as number of high risk areas traversed per year or amount of oil delivered per year per average ship size.

Just as no need for improved tank vessel maneuverability has been found, neither have we been able to determine how effective a particular improvement in maneuverability would be in reducing tanker accidents.

Because neither the need nor the effectiveness of improved maneuverability has been established, the Coast Guard feels there is inadequate justification for proposing regulations for such things as twin screws, twin rudders, bow thrusters, greater backing power, and controllable pitch propellers at this time. This is not to say that some minimum vessel design for maneuverability should not be established, But, the basis for establishing such a minimum must be its relation to the entire controllability question, and not just to the inherent maneuvering capability of the ship, as measured by standard maneuvers. When viewed in this context it becomes apparent that the minimum design standard necessary to insure safe navigation will vary for the same ship from port to port and even within the same port area during varying weather and tidal conditions. What the Coast Guard must be able to do is : (1) identify those parameters of vessel movement which accurately measure its total controllability; (2) evaluate those parameters against the acceptable level of risk for that particular harbor or waterway and weather conditions; and then (3) determine if additional precautions, such as tugs, should be required. In using such an approach, the Coast Guard will offer the prospective ship buyer incentives to incorporate those individual added design features which he feels are to his economic advantage, while at the same time allowing him flexibility in evaluating the economic trade-off of vessel design. For example, if when transiting a particular bridge under certain wind and current conditions, a tanker equipped with the conventional maneuvering systems, is by a Coast Guard regulation required to wait at anchor and thus delay its arrival, or alternatively hire tugs, and if the same tanker would have been allowed to transit the bridge had she been equipped with thrusters, the lost revenue accruing from the delay and increased ship, operating, and crew expenses, and possibly tug costs, may cause the tanker owner to install thrusters on similar designs in order to achieve an economic benefit. Another beneficial feature of this incentive approach is that it can be applied to all existing vessels, both foreign and domestic.

Reliability

So far in discussing the maneuvering aspect of controllability, we have focused on the performance of vessels as designed. Another area of maneuverability is the reliability of the installed maneuvering systems. Design features commonly discussed which would affect reliability of tank vessels are twin screws, twin rudders, twin boilers, and steering gear redundancy. Twin screws would allow partial propulsion power if one shaft were inoperable. Occurrences of breakdown when tankers were unable to proceed and subsequently resulted in pollution are very low. There were only 11 cases worldwide in the past five years during which time there accumulated approximately 21,000 tanker operating years. This record would indicate that installed propulsion systems, which were mostly single rudder, single screw systems, have been reliable.

Propulsion power for large tankers is either provided by heavy slow-speed diesel engines or by a steam power plant. The United States has had little experience with slow-speed diesels, but the reliability has been proven in European and Japanese tankers. When the steam system is used, it is conceivable that only one main boiler may be installed, but the practice is to include provision for take-home capability such as that on the nuclear powered SAVANNAH. This is often done by installing an auxiliary boiler with the capacity to propel the vessel at considerably reduced speed through the low pressure stages of the main turbine. Duplication of the steering gear system is required by Coast Guard regulations, and that, coupled with recent recommendations of the Inter-governmental Maritime Consultative Organization (IMCO), seem adequate to insure sufficient steering system reliability.

The seven-step "sequence of a casualty" discussed previously and the subsequent discussion of controllability both indicate that insuring adequate human performance is most important in preventing ship motion casualties. While much remains to be learned concerning why humans fail to perform adequately and of how the human aspect relates to the other aspects of controllability, the Coast Guard believes it is necessary now to take steps to improve human performance, and enough information is available to do so. Therefore, in the June 28, 1974, Federal Register an Advance Notice of Proposed Rulemaking entitled "Marine Traffic Requirements" was published to inform the public that the Coast Guard has determined that there must be an improvement in the operating practices aboard all major vessels on the navigable waters and to set forth our concepts about how this could be done. Many comments were received on the advance notice. They are presently being evaluated, along with other inputs, in order to arrive at an effective set of rules to meet our objectives.

Mitigating Measures

Tanker accidents cannot be totally prevented by any or all of the measures discussed above or otherwise proposed. So long as oil is moved by sea, risk of accidents involving tankers which result in the release of oil will exist. It is necessary therefore to consider measures which will minimize the effects of accidents after they have occurred. Double hull construction (double bottom, double sides, or both double sides and double bottom), reduction of tank size limits, rapid removal of oil cargo from tanks open to the sea and cleanup of spilled oil are possible measures to reduce oil outflow or its effects.

Double Bottoms

The question of how effective the installation of double bottoms, double sides, or both might be in reducing oil outflows due to tanker accidents has received considerable attention. Until very recently, there were no double bottom tankers, and so there is no accident experience to rely on. Estimates of effectiveness of these measures must rest on (1) our knowledge of how past accidents of conventional tankers have resulted in oil pollution, and (2) estimates of how effective a double bottom or side

installed in such a vessel might have been in preventing penetration of the cargo space and subsequent oil outflow. Tanker accidents, which everyone agrees occur all too frequently, are for statistical purposes relatively rare events, subject to the usual hazards of drawing inferences from relatively small samples. Table 10 presents information developed by the Coast Guard on tanker accidents over the five-year period, 1969-1973. Several important conclusions can be drawn from this information:

a. Side-damaging accidents (collisions and rammings) resulting in oil outflow occur with greater frequency than those resulting in bottom damage, the ratio being 1.4 to 1. Frequency of occurrence is one measure of pollution potential.

b. Estimates of the total quantities of outflow from these two types of accidents, e.g., side and bottom damage, are about equal and are both large enough to warrant equal concern as to design measures to mitigate outflow.

c. Structural failures have resulted in the largest amount of outflow. These are being explored further to look for causal factors.

It is important to note that the major portion of the outflow (80 percent) resulted from a small portion (2 percent) of the total number of involvements which resulted in total loss of the vessel as indicated in Table 10.

As a check on the validity of these figures for worldwide accidents, information on incidents occurring within 50 miles of the U. S. coastline is presented in Table 11. The correlation between the data is good in the area of frequency of incidents and relative outflow by accident type.

Certain known statistical factors about casualties in U. S. waters must be kept in mind. First, collisions are the prevalent accident type, overall. Also, the surrounding physical characteristics of a port area have a great deal to do with accident types to be anticipated. Where channels are wide and the water deep, collisions would be expected to dominate. Where water is shallow with respect to the using vessel's drafts, groundings should be expected. There is a wide diversity of conditions encountered in U. S. ports and even within individual port areas. It is known that most accidents to tankers do not involve breaching of the hull. Likewise, a small number of accidents involve such high energy levels that no reasonable combination of construction features would be effective.

Effectiveness of Double Bottoms

Several attempts have been made to examine reports of tanker groundings and assess after-the-fact how effective a double bottom installed in the vessel might have been in preventing oil outflow. A major problem in any such effort is obtaining the necessary information. So is the statistical design of the study. A study of vessel accidents occurring in U. S. waters, involving tankers of all sizes which suffered bottom damage resulting in

TABLE 10

TANKSHIP INVOLVEMENTS, 1969-1973, TANKSHIPS OVER 3000 DEADWEIGHT TONS

Type of Involvement	Number of Involvements	Total Losses		Involvements Resulting in Oil Outflow	
		No.	Oil Outflow	No.	Oil Outflow Amounts
BREAKDOWN	355	2	29,350	11	29,940
COLLISION	744	7	140,779	126	185,088
EXPLOSION	104	11	88,780	31	94,803
FIRE	197	1	1,250	17	2,935
GROUNDING	790	12	134,449	123	230,806
RAMMING	473	0	0	46	13,645
STRUCTURAL FAILURE	515	15	322,519	94	339,181
OTHER	5	3	54,790	4	54,911
TOTALS	3,183	51	771,917	452	951,309

Source: J. C. Card, P. V. Ponce, and W. D. Snider, "Tankship Accidents and Resulting Outflows, 1969-1973," Proceedings of 1975 Conference on Prevention and Control of Oil Pollution, San Francisco, March 1975.

TABLE 11

TANKSHIP INVOLVEMENTS OCCURRING WITHIN 50 MILES
OF U. S. COASTLINE, 1969 - 1973

Tankships of 100 Gross Tons and Over

	Number of Incidents			Number of Incidents with Outflow			Oil Outflow Amounts		
	U.S.	FN.	TOTAL	U.S.	FN.	TOTAL	U.S.	FN.	TOTAL
COLLISION	206	121	327	13	13	26	4,655	2,276	6,931
RAMMING	261	50	311	16	5	21	1,571	2,750	4,321
COLLISION AND RAMMING Subtotal	467	171	638	29	18	47	6,226	5,026	11,252
GROUNDING	304	83	387	20	9	29	3,886	11,991	15,877
STRUCTURAL FAILURE	74	7	81	8	7	15	533	5,935	6,468
TOTALS	845	261	1106	57	34	91	10,645	22,952	33,597

Source: Compiled by USCG (G-MMT-1/82) from U. S. casualty investigation reports and Lloyd's Weekly Casualty Reports, 10/74.

pollution during the period 1969-1973, revealed 30 such incidents (15). In 27 of these 30, that is, 90 percent of the cases, the extent of the vertical damage was less than 1/15 of the vessel's beam. For this sample, then, we can infer that double bottoms having a height of B/15 might have been 90 percent effective in preventing oil outflow. No similar such study has been done for tanker collision involvement.

Problems of Double Bottoms

Two potential problems arise with double bottoms: Flooding of double bottom tanks as a result of grounding could lead to loss of buoyancy and heeling due to unsymmetrical flooding making refloating and salvage more difficult, increasing risk of loss of the vessel and greater pollution. Internal leakage of cargo into double bottoms through access fittings or cracks in inner bottom could result in accumulation of explosive vapors creating an explosion hazard and toxic vapors creating a personnel hazard for anyone entering the tank. Again, because of the lack of operating experience it is difficult to assess how serious these problems are. Installation of inert gas systems serving double bottom tanks would reduce possible hazard of explosion. [The Coast Guard has issued a notice of proposed rulemaking proposing that inerting systems be required on crude oil carriers over 100,000 DWT and crude oil combination carriers over 50,000 DWT. (12)] Overall, the Coast Guard feels that these problems do not represent grounds for rejection of the double bottom concept.

The cost of incorporating double bottoms has been variously estimated at between 2 percent and 13 percent of new construction cost. Some of the higher estimates quoted are for providing both segregated ballast and double bottoms, so the incremental cost of double bottoms for ships already incorporating segregated ballast would be lower than the high estimates of reference (13).

The Coast Guard is not opposed to double bottoms, but at the time proposed rules were published in June, 1974, felt that from the accident data available, no particular type of damage so dominated the accidental release of oil that a single design solution should be stipulated in law or regulation. The data support the need to place greater emphasis on designing tank vessels from the point of view of minimizing accidental oil pollution. New tank vessels over 70,000 DWT must be designed with up to 20 percent additional volume in order to meet the segregated ballast draft and trim requirements contained in the proposed regulations. (The exact amount of additional volume depends on a number of factors including ship size, amount and location of fuel carried, and the amount of water ballast the ship carried anyway.) The Coast Guard recognized optimizing the location of this volume as defensive space could provide significant improvement toward reducing accidental outflow. A special group was convened to review the problem and examine possible regulatory approaches capable of improved protection in accident circumstances, but without specific constraints which would inhibit future development of promising design concepts not yet identified. The results and recommendations of this group are contained in Appendix C and have been incorporated in regulations setting criteria for distribution of segregated ballast.

Tank Size Limits

The alternative of reducing tank size limits is discussed in reference (17), page VI-56.

Halving of tank size limits will affect both accidental oil spillage and operational discharges. Based upon IMCO studies, reducing the tank size by a factor of two would reduce accidental oil outflow from a standard 250,000 DWT tanker by approximately 17 percent. Increasing the number of bulkheads will increase the complexity of piping and create more surface area to which oil cargo can cling during the discharge operation. This increases the amount of oil which must be cleansed from the tank and separated out during LOT and sludge removal operations. Therefore, further subdivision of cargo tanks will tend to increase the amount of oil pollution due to tanker operations thereby offsetting the reduction from accidental pollution. In addition to increased complexity of piping systems, other disadvantages of reducing tank size are increased steel weight of vessel (reduced DWT), increased chance for overfilling a tank during tank loading operations and longer loading times.

The formula adopted for segregated ballast distribution criteria does require decreased tank sizes in some construction options. For example, should a designer choose to use a staggered wing distribution of ballast, tank sizes must be considerably reduced for the vessel to meet the distribution criteria.

Structural Failures

As indicated in Table 10, structural failures resulted in the largest amount of outflow from tanker accidents over the five-year period, 1969-1973, and the bulk of this was from ships which were total losses. Table 12 presents results of a separate survey of 47 tankships lost, showing that loss of ship as a result of structural failure of the main hull girder was the largest single source of oil outflows.

There are a number of factors which affect the overall structural integrity of tankers over their service life. The initial strength of the vessel depends on the ship designer, ship builder, and the classification society and regulatory agencies they work with. During the vessel's operating life, its strength may be affected by the amount and distribution of the weights it carries, the weather and sea conditions it operates in, and the deterioration due to corrosion or other causes.

The structural design of ships is a complicated process. Merchant ships must have adequate structural strength for the service they are to see,

TABLE 12

DESCRIPTION OF LOSS OF STRUCTURAL INTEGRITY
FOR 47 TANKSHIP LOSSES, 1969-1973

TANKSHIPS OVER 10,000 DEADWEIGHT TONS

Description	Number	Oil Outflow (Long Tons)
A. Loss of structural integrity of hull caused primarily by external forces or where local material conditions deteriorated. No explosion or fire was associated with the accident. These may be broken down into:		
1. Structural failure of main hull girder from excess bending or shear loading	12	243,619
2. Local structural failure of hull envelope		
a. Failure of hull penetration	2	36,750
b. Local hull plating failure	2	39,169
c. Unknown local structure failure	1	34,000
3. Hull damage caused by collision or grounding		
a. Collision	2	4,138
b. Grounding	11	187,726
SUBTOTAL	30	545,402
B. Loss of structural integrity from damage caused primarily by explosion or fire or where explosion or fire contributed to loss of structural integrity. These may be broken down into:		
1. Explosion or fire initiated in own ship cargo tanks	12	90,030
2. Explosion or fire set off by vessel collision or grounding		
a. Collision	4	136,163
b. Grounding	1	2,500
SUBTOTAL	17	228,693

with margins for unknowns and normal wear and tear. There is little virtue in excessive strength beyond this point, since it involves excess weight, higher transportation costs, and less efficient operation. The problem is to determine "adequate structural strength" and the required margins. There are two basically different approaches to structural design -- "evolutionary" and "deterministic." The first of these develops satisfactory rules and procedures on the basis of trial, experience, and modification. In the "deterministic" approach, as many of the factors affecting the structure throughout its life as possible are determined, and this information is used to prepare a design with a minimum of reference to previous experience. Loading on the ship, material properties, corrosion rates, detailed response of the structure to each state of loading, and much more must be quantified, and then the effect of these things on the probable behavior of the structure during its lifetime taken into account, largely by calculation (18)

Ship structural design currently uses a combination of these two approaches, with a growing tendency toward "deterministic" methods where no relevant previous operating experience exists. A completely deterministic approach is not feasible, however. In general, the data and statistical techniques for calculating risks of failures are not presently available. Uncertainties concerning loadings, quality of material and construction, and accuracy of analysis are taken into account by the use of margins of safety against damage selected by the designer with the help and supervision of the classification societies and regulatory agencies. Once information needed to calculate risks of failure is available, the problem of determining "What is an acceptable risk of failure?" will remain. (18)

Strength during a vessel's life may be affected by overloading, improper load distribution, encountering rougher weather or seas than it was designed for, or deterioration of structure due to corrosion.

Limiting draft of a vessel may be determined by structural strength, freeboard needed to prevent damage due to boarding seas, or reserves of buoyancy or stability needed after loss of hull integrity. The 1966 Loadline Convention contains no strength standard, inasmuch as the various assigning authorities were not in agreement as to a proper standard. There was a universal feeling that for larger ships freeboards could safely be reduced. The final freeboard table for large ships, particularly for tanker and similar types, showed greatly reduced freeboards at the upper limit of length. However, in order to obtain the reduced freeboard, a ship must meet certain standards of subdivision and stability in a damaged condition. As a result, it is generally felt that ships will be safer, despite the reduced freeboards, because of the subdivision requirement. (19)

The requirement contained in the 1966 Loadline Convention for load distribution information to be provided to the Master of a ship will help to eliminate improper load distribution, perhaps a greater risk than overloading.

Deterioration of a ship's structure due to corrosion or wastage is also a complicated problem. In the past it has been taken into account by

AD-A036 719 COAST GUARD WASHINGTON D C OFFICE OF MERCHANT MARINE--ETC F/G 13/2
REGULATION FOR TANK VESSELS ENGAGED IN THE CARRIAGE OF OIL IN D--ETC(U)
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including a wastage allowance in the ship's scantlings. The proper allowance, being based on a predetermined period before the strength of the structure is reduced to the established minimum, is impossible to determine with exactness. Corrosion itself is a complex electrochemical phenomenon affected by a multitude of factors. (20) Loading systems, cathodic protection, and materials improvements have been used in various ways to reduce corrosion effects. Periodic inspection and maintenance to locate and correct abnormal wastage problems are also essential.

Collection and analysis of accident statistics as a check on the structural performance of tankers is important, but this information has not generally been collected and made public worldwide, although presumably the classification societies have a good deal of such information. To provide input for revising requirements (either loadline or wastage allowance requirements) this information should include information on factors noted above.

Studies of tanker accidents seem to show an age dependency of structural failures with most failures occurring after ships are over 12-15 years of age. This is probably due to the combination of a number of factors -- latent design and construction defects, deterioration of vessel's structure with age, extreme sea conditions, or other factors we do not know about. (One of the most troublesome problems is obtaining information after an accident has occurred.) Accidents involving U. S. vessels or foreign vessels in U. S. waters are investigated and published by the U. S. Coast Guard and the National Transportation Safety Board. Some other maritime nations similarly investigate and publish reports of serious accidents involving their vessels. A number of countries do not, so information on many accidents is very sketchy or nonexistent. Are these accidents the result of conditions which do not apply to other tankers (poor workmanship in one construction yard during one time period, design details unique to one vessel or class of vessel, lack of or failure of protective coating, etc.) or to more general conditions (widespread overloading, corrosion, etc.)? No one really knows.

What alternatives are available for reducing tanker structural failures? For new ships, greater initial strength could be required (increased safety factor), but how much? This would result in an increase in the amount of steel used in these ships, increased weight, increased cost, etc. The allowable loading of new and existing vessels could be reduced by increasing required freeboard and changing loadline assignments. (Unknown here is how widespread the practice of overloading is at present. It is difficult to detect overloading. Mere observation of a vessel at start and end of a voyage is not sufficient to determine that a vessel was not overloaded at some point in the trip because of the route and loadline zones transited. Many masters may be unaware of the hazards of overloading. The effects of overloading may be cumulative -- a vessel may be overloaded and still complete the voyage safely for many voyages before it is lost.) The periodic inspection of a tanker's hull to detect signs of deterioration which might lead to structural failure is a major task and it is growing as larger tankers enter service. The immensity and difficulty of this task alone may require a change in design allowances for corrosion and safety factors.

Other Accident Types

Fires and explosions are not major sources of oil outflow. They are serious safety problems from personnel and property damage standpoint and efforts are currently underway in the U. S. and internationally to upgrade fire protection systems on tankers and to require tank inerting systems. Reducing fires and explosion will also reduce accidental pollution, but the effect will be small.

The problem of breakdowns and equipment reliability were discussed earlier. The vessel's crew and owners (or operating company) play a major role in maintaining a vessel in satisfactory condition. Breakdowns in the past have contributed only a small amount to oil outflows -- they are a safety and operating efficiency problem.

4.5 Future Actions by the Coast Guard

As indicated earlier, these regulations are one of a series of steps to reduce oil pollution from tankers. Some of the other steps to be taken are described below:

1. Specifications for oil/water separators, oil content monitors, and oil interface detectors are to be developed and published.

2. Proposed regulations to cover ships other than tankers which have their certificates endorsed to carry small amounts of bulk liquid cargo are to be developed and published for comment.

3. Proposed rules on marine traffic requirements are to be developed and published for comment as a followup to the Advance Notice published June 28, 1974.

4. The Coast Guard will encourage ratification of the 1973 Marine Pollution Convention by the United States and work to bring it into force internationally. The Coast Guard will continue to participate in meetings of the Marine Environmental Protection Committee of IMCO and work toward international solutions to marine pollution problems.

5. The need for additional construction requirements for inland tank barges is being analyzed and proposed regulations will be drafted in the future.

6. Proposed rules for U. S. tankers in foreign trade and foreign tankers entering U. S. waters will be developed and published for comment in order to have final rules effective as required by Title II of PWWSA.

7. Regulations to implement the 1973 Marine Pollution Convention for ships other than tankships will be developed. These regulations will apply to the discharge of oily ballast and bilge water at sea from vessels other than tankers.

8. The Coast Guard will work with other Federal agencies and appropriate facets of the marine industry to see that required reception facilities are available to reduce oily bilge and product tanker discharges to the sea.

9. The Coast Guard will continue to work on ship controllability problems to reduce collisions, rammings, and groundings.

5. PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

The overall effect of these regulations will be to reduce the amount of oil entering the oceans as indicated in Section 3. No adverse environmental effects are anticipated as a result of this action.

6. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Both short-term and long-term fates and effects of petroleum hydrocarbons in the marine environment are analyzed in the NAS Report, Petroleum in the Marine Environment (reference 1). So far as the Coast Guard can determine, these regulations do not involve any tradeoffs between short-term environmental gains at the expense of long-term losses or vice versa. Nor are any future options foreclosed.

7. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

No significant irreversible and irretrievable commitments of resources are involved in this proposed action.

8. COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT AND COAST GUARD RESPONSES

Comments on the draft statement were requested from the following (* indicates comments were received and are contained in this section):

Department of the Interior
*Environmental Protection Agency
*Department of Defense
*Department of Commerce
*Department of Transportation
Department of State
Sierra Club
Connecticut Citizens Action Group
*Center for Law and Social Policy (representing a number of groups (CLSP)
*American Petroleum Institute
*American Institute of Merchant Shipping
American Association of Port Authorities
American Maritime Association
American Waterways Operators, Inc.
Shipbuilders Council of America
Environmental Policy Center
Coalition Against Oil Pollution
*National Audubon Society (AUD)

In addition, comments were received from the State of New Jersey, Department of Environmental Protection.

USCG

ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

AUG 9 1974

OFFICE OF THE ADMINISTRATOR

Mr. Martin Convisser, Director
Office of Environmental Quality
Department of Transportation
400 7th Street, S.W
Washington, D.C. 20590

Dear Mr. Convisser:

The Environmental Protection Agency (EPA) has reviewed the draft environmental impact statement (EIS) for "Proposed Regulations to Implement Port and Water Safety Act of 1972". The statement discussed proposed regulations governing construction standards for U.S. tank vessels carrying oil in coastwise trade. The proposed regulations are based on standards adopted by the International Conference for Prevention of Pollution from Ships, 1973. It is understood that, after January 1, 1976, these regulations will apply to U.S. tank vessels in foreign trade and foreign tank vessels entering navigable waters of the U.S. and also that no substantive changes in the regulations are anticipated.

In general, we find that the statement has adequately assessed the environmental impacts of the proposed regulations and EPA has no objection to the proposed regulations as described. We appreciate the opportunity to review this statement.

Sincerely,

for

Sheldon Meyers
Director
Office of Federal Activities (A-104)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

23 AUG 1974

OFFICE OF THE ADMINISTRATOR

Captain S.A. Wallace
Chief, Marine Environmental Protection Division
U.S. Coast Guard (G-WEP/73)
Washington, D.C. 20590

Dear Captain Wallace:

The Environmental Protection Agency has completed a further review of the U.S. Coast Guard's draft environmental impact statement entitled, "Proposed Regulations to Implement Port and Water Safety Act of 1972." We wish to amend our comments of August 9, 1974, with the following comments:

We were pleased to note inclusion of the provision for segregated ballast tanks (Sec. 157.09), but we were disappointed that the regulations were only for vessels of more than 70,000 DWT and did not require double bottoms on all new construction.

The regulations provide an improvement over the status quo, but they do not go as far as they could, nor do they provide any mechanism to reduce oil outflow in the event of a grounding. We feel that the case supporting your conclusion on segregated ballast is very strong, but we argue that it should be applied to all new tankers over about 10-25,000 DWT. EPA has estimated that at least 70% of the ocean pollution caused by tankers is the result of discharge of oily ballast waters.

The Coast Guard has found that pollution from ballasting operations can be reduced by 90-95% by segregating ballast water. Furthermore, existing alternatives to segregated ballast systems are environmentally unsatisfactory because they have an oil/water interface and thereby provide an opportunity for some of the most toxic hydrocarbons, such as aromatics, to dissolve in the ballast water and eventually be discharged into the open sea.

We feel, however, that no valid case was made for not including double bottoms in the regulations. We believe that groundings will be a clear risk to vessels operating under these regulations because the vessels will be engaged in domestic trade and will operate almost exclusively in coastal zones where a navigational error or equipment casualty can lead immediately to an accident. Double bottoms are the only effective method to reduce oil outflow in the event of a grounding, and their use can reduce the expected amount of pollution caused by groundings by about 50-65% (according to the note by the United States on Segregated Ballast Tankers prepared by the Coast Guard and presented to the Intergovernmental Maritime Consultives Organization (IMCO) Conference in London, October 1973).

The United States' position, at the IMCO Conference was that all nations should require segregated ballast and double bottoms on the maximum practicable number of tankers. As you know, the Conference recommended segregated ballast on tankers contracted after January 1, 1976. We are hopeful that the Conference will consider the double-bottom issue at a future time.

The arguments against double bottoms are primarily cost, use of domestic tankers in international trade, safety, and effectiveness.

The Coast Guard has estimated that the capital cost premium of double bottoms is 8.5% over a ship without segregated ballast or double bottoms. In our view, the benefit that would accrue in environmental protection from this cost is analogous to the national security benefits that justify our subsidy program. Secondly, double bottoms are primarily a capital cost item and can reduce some significant operating costs, such as insurance, and tank stripping.

Regarding the potential for chartering these vessels for international trade, it is our view that it is very unlikely that ships built under this program will be used in free international trade because their operating costs are already far in excess of foreign ships. In the event that they are used internationally, the incremental operating expense, if any, due to double bottoms will probably be too slight to affect the decision.

Safety is always a major concern on fuel tankers especially regarding the possibilities of oil seeps into voids, or unmanned spaces, such as double bottoms. Voids are commonly filled with inert gases to prevent explosion. If double bottoms are used, they too should be filled with pressurized inert gas.

Although a number of systems are very effective at reducing the risk of encountering an accident, only double bottoms can effectively reduce the amount spilled once an accident occurs. EPA feels that we should emphasize accident prevention, but that we would be irresponsible if we neglect a feasible system to mitigate the adverse consequences of a grounding. The assertion, made in the regulation, that "The large number of existing vessels would preclude any immediate significant reduction in oil outflow due to requiring double bottoms," is not a valid argument for avoiding a requirement that new vessels install double bottoms, and underestimates the effect of the regulation on the shipment of oil from Alaska.

In accordance with our procedure to categorize our comments on draft impact statements, we have rated this statement as ER-1. A copy of the definition of our categories is enclosed for your information.

Thank you for the opportunity to make additional comments on these proposed rules. Please feel free to contact us regarding any questions you may have concerning these remarks.

Sincerely yours,

Sheldon Meyers

Sheldon Meyers
Director
Office of Federal Activities

Enclosure

Environmental Impact of the Action

LO--Lack of Objections

EPA has no objections to the proposed action as described in the draft impact statement; or suggests only minor changes in the proposed action.

ER--Environmental Reservations

EPA has reservations concerning the environmental effects of certain aspects of the proposed action. EPA believes that further study of suggested alternatives or modifications is required and has asked the originating Federal agency to reassess these aspects.

EU--Environmentally Unsatisfactory

EPA believes that the proposed action is unsatisfactory because of its potentially harmful effect on the environment. Furthermore, the Agency believes that the potential safeguards which might be utilized may not adequately protect the environment from hazards arising from this action. The Agency recommends that alternatives to the action be analyzed further (including the possibility of no action at all).

Adequacy of the Impact Statement

Category 1--Adequate

The draft impact statement adequately sets forth the environmental impact of the proposed project or action as well as alternatives reasonably available to the project or action.

Category 2--Insufficient Information

EPA believes that the draft impact statement does not contain sufficient information to assess fully the environmental impact of the proposed project or action. However, from the information submitted, the Agency is able to make a preliminary determination of the impact on the environment. EPA has requested that the originator provide the information that was not included in the draft statement.

Category 3--Inadequate

EPA believes that the draft impact statement does not adequately assess the environmental impact of the proposed project or action, or that the statement inadequately analyzes reasonably available alternatives. The Agency has requested more information and analysis concerning the potential environmental hazards and has asked that substantial revision be made to the impact statement.

If a draft impact statement is assigned a Category 3, no rating will be made of the project or action, since a basis does not generally exist on which to make such a determination.

Response to Environmental Protection Agency Comments contained in EPA letters dated August 9, 1974 and August 23, 1974

Comment

We were disappointed that the regulations require segregated ballast only for vessels of more than 70,000 DWT and did not require double bottoms for all new construction. Segregated ballast should be provided on all new tankers over about 10-25,000 DWT.

Response

The EIS has been revised to explain more fully the reasons why segregated ballast is not required on ships smaller than 70,000 DWT in these rules. The need to adopt regulations consistent with the 1973 Marine Pollution Convention is discussed on pages 7 and 8. Effectiveness of segregated ballast in avoiding pollution is discussed on page 61.

Comment

We feel that no valid case was made for not including double bottoms. Double bottoms are the only effective method to reduce oil outflow in the event of a grounding, and their use can reduce the expected amount of pollution causes by groundings by about 50-65%. Although a number of systems are very effective at reducing the risk of encountering an accident, only double bottoms can effectively reduce the amount spilled once an accident occurs. EPA feels that we should emphasize accident prevention, but that it would be irresponsible if we neglect a feasible system to mitigate the adverse consequences of a grounding.

Response

The discussion of double bottoms has been greatly expanded and now appears on pages 72-76. While double bottom spaces may be effective in grounding accidents, they are not effective against collision damage. Efforts to arrive at a formula for effective distribution of segregated ballast spaces to mitigate effects of collision or grounding accidents are described on page 19 and in Appendix C. After a thorough review of all the factors involved, the Coast Guard feels that the final regulations are a significant step forward. Other steps and more work remain in the continuing process toward international control of oil inputs to the world's oceans.

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON, D.C. 20350

IN REPLY REFER TO
Ser 452/4623
25 July 1974

Captain S. A. Wallace, USCG
Chief, Marine Environmental Protection Division
Headquarters, U. S. Coast Guard (GWEP/73)
Washington, D. C. 20590

Dear Captain Wallace:

The Department of Transportation Draft Environmental Impact Statement concerning Proposed Regulations to Implement the Ports and Waterways Safety Act of 1972 (P. L. 92-340) was assigned to this office for review and direct response on behalf of the Department of Defense.

The draft document has been reviewed and is considered to adequately describe the relationship of the proposed regulations to various national and international efforts to improve the quality of the world's marine environment.

Sincerely,

J. B. Groff

J. B. GROFF
Commander, USN
Director, Environmental Protection Division
By direction of the Chief of Naval Operations

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230

August 19, 1974

Commander J. H. Costich
U.S. Coast Guard
Chief, Environmental Coordination Branch
By direction of the Commandant
400 Seventh Street, SW
Washington, D. C. 20590

Dear Commander Costich:

The draft environmental impact statement "Proposed Regulations to Implement Port and Water Safety Act of 1972, (P.L. 92-340), Title II, as amended," which accompanied your letter of June 26, 1974, has been received by the Department of Commerce for review and comment.

The statement has been reviewed and the following comments are offered for your consideration.

There are several important economic considerations not dealt with in the statement. First, the report fails to examine what impact the proposed regulations will have on the U.S. merchant fleet. As the report notes in the third paragraph on page 47, the cost of construction of new ships will be raised by at least five percent by the proposed segregated ballast spaces requirement. The report does not explore whether such a substantial increase in building costs will dissuade U.S. tanker lines from adding to their current fleets and thus allow foreign shippers to increase their share of the market.

If that increased cost does discourage expansion of the merchant fleets, then the regulations could have very significant economic costs. Moreover, the further loss of business to U.S. shipyards would have a ripple effect on the economy, harming several basic industries.

In addition to affecting new shipbuilding, the proposed regulations could also dissuade U.S. shipping lines from modernizing and maintaining their current fleets. The inclusion of ships undergoing "major conversion" (page 9) among the vessels affected by the new construction requirements will increase the costs of maintaining tanker fleets and thus further contribute to the decline of the American fleet and allow those nations not subscribing to the standards established by the 1973 International Conference for the Prevention of Pollution from Ships to gain a competitive advantage. Moreover, the inclusion of those ships whose conversion had begun after January 1, 1972, within the vessels required to comply with the standards on tank size and arrangement, will have an immediate impact on American shipbuilding and will result in unplanned costs for both the shipbuilder and the buyer.

Another economic factor not adequately explored by the statement is the effect of the slower speeds on shipping rates that will result from the new anti-pollution regulations, especially the LOT system of purifying ballast water. The admitted lower speeds will result in less efficiency and thus less revenue, forcing fleet owners to consider higher freight rates.

Another important point is whether the U.S. will be at a commercial disadvantage by implementing these regulations which will raise not only the cost of building, but also the cost of operating the vessels. If the U.S. can consider the possibility of not subscribing to the requirements of the International Conference (page 50), then so can other nations.

A final consideration is what effect these new regulations will have on the price of oil and oil products in the United States. In light of the recent demonstration of America's dependence on imported oil, the economic effects of another increase in oil prices must be carefully examined. Such an increase could have widespread effects and feed the already dangerous inflation rate. It, therefore, should be considered in preparing the final environmental impact statement.

Our comments on the more technical aspects of the statement are as follows:

Page 7. We recommend that this section include a statement on the degree to which the regulations are expected to be "interim," as indicated on page 1.

Page 9, Last Paragraph. The "baseline" from which the territorial sea of the U.S. is established in accordance with international law includes, in places, closing lines across bays, etc. which are straight lines and which do not appear on the navigational charts used by mariners. An offense could be committed because of ignorance of the position of this line. Consideration is being given to charting these "baselines" and the 3 and 12 mile limits determined from them, but final decisions are dependent upon the Law of the Sea deliberations. This comment does not criticize the Coast Guard terminology, but is intended to reinforce the position that the lines must be added to the navigational charts.

Page 22. It is clear that present levels of oil pollution represent a serious threat to the marine and coastal environment. In relation to the proposed discharge criteria, we recommend that the known hydrocarbon toxicity levels be reviewed, thus providing a background to the proposed requirements.

Toxicity levels that have been reported vary by species and stage of development. In his summary of effects of oil pollution, Nelson-Smith (1970) reported that toadfish embryos die in one day at 100 p.p.m. and within five days at 5 p.p.m. Wells (1972) reported that crude oil was rapidly lethal to larvae of the American lobster (Homarus americanus) at 0.1 ml/L, whereas sublethal effects were noted at concentrations of 0.01 and 0.001 ml/L. Concentrations of 0.1 to 0.001 ml/L were also found to be toxic to larval crabs and shrimps. Mironov (1968) reported injury to the spawn of plaice (Rhombus maeoticus) at concentrations of 0.001 and 0.0001 ml/L. Larval plaice appeared to be particularly sensitive as they enter surface waters.

Pages 22-23. The statement discusses impacts of oil pollution on aquatic resources, but does not describe how the proposed regulations would reduce the future pollution impact.

Page 25. The origins of various sources of marine oil pollution are discussed. However, the distribution of pollutants and the sources of pollution in the ocean is not discussed. Heyerdahl (1971) discussed observations on surface oil and gave attention to the extent of surface oil pollution, its possible association with shipping, and its eventual dispersal. Wellman (1973) reported samples of surface oil outside regular shipping lanes.

The occurrence of surface oil, in its various forms, has been reported many times, and has resulted in surveys and monitoring programs. Therefore, we believe the topic of surface oil distribution warrants more intensive evaluation in this environmental impact statement.

We recommend that the statement expand this section with respect to the frequency, within geographical regions, of accidental spills and of attempts made to observe and monitor accidental spills. The present level of operational discharge should be assessed by geographical area. Biological and economic impacts at locations with high levels of operational discharge and/or high levels of accidental discharge should be reviewed.

We believe the statement should contain a discussion of the fate of oil in the marine environment. Blumer and Sass (1972) reported considerable environmental persistence of oil products following an oil spill. Wellman (1973) has speculated on the persistence of several types of petroleum tar fragments. The low rate of bacterial degradation of oil products, particularly for oil trapped in sediment, should be considered and discussed in the evaluation of discharge criteria.

We recommend that a section be added dealing with the attempts made to monitor marine oil pollutants. Mention should be made of the IGOSS (Integrated Global Ocean Station System) program, sponsored by the Intergovernmental Oceanographic Commission and the World Meteorological Organization. Part of this program will be devoted to global monitoring of marine oil pollution, oil transportation, marine tar, oil slicks, and dissolved hydrocarbons.

<u>Page 27, Table IIIB-1</u>. Change "Table IIIB-1" to "Table B-1".

<u>Pages 32-34, Tables B-2 and C-1</u>. The data in Table B-2 and Table C-1 are contradictory unless Table B-2 refers solely to tank ships and Table C-1 relates to tank vessels, i.e. ships and barges. For example, the four year worldwide statistics of Table B-2 indicate an annual collision rate of 179/4 or 45. Table C-1 indicates the annual collisions in or around U.S. waters as 52. Also the total outflow listed in Table B-2 of 874,396 tons conflicts with the 876,040 tons stated in the preceding text.

Page 33. We recommend that the petroleum trade be summarized by size and class of vessel and the type of product carried in the U.S. flag vessels. This information should be correlated with accidental discharge, and estimated for operational discharge. The information could be included in Table C-1.

Since as mentioned on page 35, the data base year (CY 1972) is possibly misleading, we recommend that, if available for analysis, some estimate be included for 1973 and for the years preceding 1972.

Page 35. The statement ". . . a double bottom fitted only in U.S. tank ships in the domestic trade would prevent only a fraction of the total outflow and that efforts in preventing casualties should be emphasized," is correct. It should be stated that double bottoms are primarily designed to prevent pollution from groundings, not collisions.

Page 37. Five criteria must be met prior to the discharge of an oily mixture from a cargo tank, and four criteria must be met prior to discharge from a machinery space bilge. We recommend that the following be given additional discussion, either under this section heading or in the section on alternatives: (1) 60 liters per nautical mile, (2) total quantity of 1/15,000 or 1/30,000, (3) effluent from a machinery space bilge less than 100 p.p.m.

We recommend that the oil monitoring system and components being considered for the system be discussed in detail.

Page 39, Paragraph 1. For vessels requiring reception and processing facilities, we recommend that some identification be made of areas and ports most likely to require additional or enlarged facilities for oily waste. Possibly a summary of the effectiveness of the existing facilities might be provided. Some discussion should be given to reception and processing facility design and efficiency as influenced by the proposed action.

Page 40, Paragraph 1. The term "tank vessel" is inaccurate since tank barges are excluded. Also, the Maritime Administration's Merchant Marine Data Sheet for June 1, 1974, shows a total of 276 tank ships (active and inactive) with an average deadweight tonnage of slightly under 32,000 tons.

Page 42, Table D-1. The term "deadweight" is not an accurate heading for the amount of cargo carried. In addition it would be helpful to state the density ranges for various cargoes, e.g., crude oil, fuel oils, diesel oils, etc.

Page 43, Table D-2. The data in Table D-2 cannot be related to that in Table D-1. For example, a tank ship carrying 30,000 metric tons of cargo can discharge at 60 liters/nautical mile for the following distance:

$$660 \text{ gallons} \times 3.785 \ \frac{\text{liters}}{\text{gallon}} = 2{,}498 \text{ liters}$$

$$2{,}498 \text{ liters} \times \frac{1}{60 \ \frac{\text{liters}}{\text{nautical mile}}} = 41.6 \text{ nautical miles}$$

Page 50, Paragraph 4. This section should include specific estimates and examples.

Page 52, Paragraph 2. Facilities could achieve discharge of less than the 10-15 p.p.m. oil in water, with current technology. Peoples (1971) reported oil reductions to 1.8 mg/L, and Shell, et. al. (1971) reported reductions to 1.0 mg/L. The Interstate Sanitation Commission, in its statement on the "High Priority for Abatement of Oil Pollution" (1974), has, pursuant to Section 303 of the Federal Water Pollution Control Act, presented some evidence for a 1 mg/L limitation on oil discharges.

Also, in connection with this paragraph it would be useful to state that the discharge zones for shoreside facilities very often are valuable and sensitive ecological areas.

Page 53, Paragraph 4. The statement should be revised to show that the Environmental Protection Agency is now regulating discharge standards at the terminal at Valdez, Alaska, and that the phrase "zero discharge" is not applicable inasmuch as a daily average discharge of 8 mg/L is being considered.

Page 54, Paragraph 2. It would be helpful to explain why segregated ballast is most effective when used in tankers carrying crude or residual oils.

Page 54, Paragraph 3. Double bottom construction should be given a complete evaluation as an alternative either here or on page 35. We strongly recommend that the economic and safety aspects of this alternative be explored completely and presented in the final statement.

Page 55, Paragraph 3. The legal, social, economic, and pollution control efficacy of a U.S.-imposed restriction on foreign vessels not meeting construction and safety standards could be explored as an alternative.

Page 59, Paragraph 3. The studies done by the National Oceanic and Atmospheric Administration should be referenced.

Thank you for giving us an opportunity to provide these comments which we hope will be of assistance to you. We would appreciate receiving a copy of the final statement.

Sincerely,

Sidney R. Galler

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

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Response to Department of Commerce

Comments in letter dated August 19, 1975

Comment

There are several important economic considerations not dealt with in the statement . . . the report does not explore whether such a substantial increase in building costs will dissuade U. S. tanker lines from adding to their current fleets and thus allow foreign shippers to increase their share of the market.

In addition to affecting new shipbuilding, the proposed regulations could also dissuade U.S. shipping lines from modernizing and maintaining their current fleets.

Another important point is whether the U.S. will be at a commercial disadvantage which will raise not only the cost of building, but also the cost of operating the vessels.

Response

These regulations will require additional capital investment in vessels and equipment and increased operating costs. In a freely competitive market the natural laws of economics would favor those operators who have the least cost. So one could expect a foreign shipper with no pollution prevention costs to be more competitive than a U.S. shipper with those costs. However, the market involved here is reserved for U.S. ships and not open to foreign competition. Furthermore, in 1976 these regulations will be applied to foreign ships entering U.S. waters thereby reducing whatever competitive advantage might otherwise be enjoyed by foreign ships.

The Coast Guard believes that the relatively small costs involved in equipping vessels with the oil discharge monitoring and control systems, oily water separating equipment, and piping modifications required (see pages 53-55) will not be a deciding factor in any decisions by U.S. shipping lines not to modernize or maintain their current fleets.

The Coast Guard agrees that economic and foreign trade factors are important and these have been taken into consideration.

Comment

Another economic factor not adequately explored by the statement is the effect of the slower speeds on shipping rates that will result from the new antipollution regulations, especially the LOT system of purifying ballast water.

Response

The Coast Guard does not expect to see any substantial speed reduction or slower shipping rates as a result of these rules. Reduced speed would be required only in the case of very short voyages (less than 4-5 days) where there were no reception facilities at the loading port. The Coast Guard believes the occurrence of such circumstance will be infrequent. The impact on shipping rates will be small, particularly when viewed in the context of current tanker surpluses and speed reductions to save fuel.

Comment

A final consideration is what effect these new regulations will have on the price of oil and oil products in the United States.

Response

The statement has been revised to include a more complete discussion of the economic impact. Table 9 on page 56 has been added to show the effect of a 10% increase in required freight rate on the cost of oil and oil products. As the discussion there indicates, estimates of increase in required freight rate due to increased capital cost cover the range 4-10%.

Comment

Recommend section include a statement on the degree to which the regulations will be interim.

Response

The use of the term "interim" to describe the regulations proposed June 28, 1974, was intended to convey the idea that they contained rules which would in 1976 be extended to cover U.S. ships in foreign trade and foreign ships. The statement has been revised to convey this idea without using the word "interim" which confused a number of people.

Comment

In relation to the proposed discharge criteria, we recommend that the known hydrocarbon toxicity levels be reviewed, thus providing a background to the proposed requirement.

Response

Levels of hydrocarbon toxicity for various marine organisms are discussed in detail in Appendix B, which points out how little is known about the fate and effects of petroleum hydrocarbons in the marine environment. It is not possible to evaluate how the proposed discharge criteria will affect individual marine organisms. However, the regulations will reduce the amount of oil entering the oceans, and if the discharge criteria were adopted internationally, a substantial environmental benefit could be expected.

Comment

The statement discusses impacts of oil pollution on aquatic resources, but does not describe how the proposed regulations would reduce the future pollution impact.

Response

Pages 4 through 52 of the statement, along with Tables 5, 6, and 7, discuss how the regulations would reduce the future pollution impact. (Table 5 is on page 44; Table 6 is on page 46 ; and Table 7 is on pages 51 and 52.

Comment

We believe the topic of surface oil distribution warrants more extensive evaluation in this environmental impact statement.

We recommend that the statement expand this section with respect to the frequency, within geographical regions, of accidental spills and of attempts made to observe and monitor accidental spills. The present level of operational discharge should be assessed by geographical area.

Response

The statement has been revised by adding Table 4 on pages 36 and 37. This table estimates the amount of oil deposited annually in U.S. waters due to operational and accidental pollution. "U.S. waters " is defined as within fifty miles of the U.S. coastline. The majority of the operational pollution occurs along the Atlantic Coast because of the heavy tanker traffic in that region. As is discussed on pages 35 and 39 of this statement, a more detailed geographic distribution of these oil inputs is not known.

Comment

We believe the statement should contain a discussion of the fate of oil in the marine environment.

Response

The fate of oil in the marine environment is discussed in Appendix B, page 236, and in the NAS report Petroleum in the Marine Environment (reference 5) from which Appendix B is reprinted.

Comment

We recommend that a section be added dealing with attempts made to monitor marine oil pollutants.

Response

Studies, including the Marine Pollution Pilot Project, part of the Integrated Global Ocean Station System (IGOSS) program, being made in an attempt to monitor marine pollutants are discussed on page 35.

Comment

"The data in Table B-2 and Table C-1 are contradictory unless Table B-2 refers solely to tankships and Table C-1 relates to tank vessels, i.e., ships and barges."

Response

Table B-2 in the draft statement shows tankship casualties on a worldwide basis which resulted in pollution for the years 1969 through 1972. Table C-1 in the draft statement is extracted from the Coast Guard's Polluting Incidents In and Around U.S. Waters, Calendar Year 1972. The tables are from two completely different data bases,and therefore, cannot be compared. When revising the statement the Coast Guard eliminated Tables B-1 and C-1 and included Table 4, which, we think, more clearly describes oil inputs from tankers. (pages 36 and 37)

Comment

We recommend that the petroleum trade be summarized by size and class of vessel and the type of product carried in the U.S. flag vessels. This information should be correlated with accidental discharge, and estimated for operational discharge.

Response

Section 3.2 of the statement, page 31 has been revised to include a discussion of size and class of vessels and the type of oil carried. A correlation of amounts of and types of oil carried with location and operational and accidental pollution would be very interesting. However, the information available does not allow such correlations to be made. Perhaps when data on individual movements of oil are recorded so that such data can be readily accessed, such correlations can be made.

Comment

We recommend that the following be given additional discussion: (1) 60 liters per nautical mile, (2) total quantity of 1/15000 or 1/30,000, (3) effluent from a machinery space bilge less than 100 ppm.

Response

The discussions of discharge standards for both cargo residues and bilge wastes have been completely rewritten in this statement. The new discussions include a comparison of the new standards to existing standards (page 17), to what degree the new standards reduce operational pollution (pp 45-47) and the effects of requiring more stringent discharge standards (pp 59-62).

Comment

We recommend that the oil monitoring system and components being considered for the system be discussed in detail.

Response

Pages 15 and 47 of the statement discuss oil monitoring systems and the main components of those systems. Page 15 of the statement describes a typical oil monitoring system and the components of that system, and page 47 discusses these components in greater detail.

Comment

For reception facilities, we recommend that:

a. "Identification be made of areas and ports most likely to require additional or enlarged facilities."

b. " . . . a summary of the effectiveness of the existing facilities be provided."

c. "Some discussion should be given to reception and processing facility design and efficiency as influenced by the proposed action."

Response

The questions of where additional reception facilities will be required, how effective these facilities will be, and facility design and capacity are discussed on pages 45 and 47 of the statement.

Comment

The section on more stringent requirements than the 1973 Convention should include specific estimates and examples.

Response

The section discussing the alternative of adopting more stringent requirements than those in the 1973 Marine Pollution Convention has been completely rewritten. Various alternatives are considered and their effects examined. See pages 59-81.

Comment

Facilities are capable of achieving discharge standards of less than 10-15 ppm with current technology. Several citations were given.

Response

In preparing the statement several sources were checked with the result that 10-15 ppm was the average discharge reported. According to the sources suggested by the comment, better results are achievable. As noted in the DOC letter, a daily discharge of 8 mg/l is considered a reasonable goal for the facility proposed for Valdez.

Comment

" . . . it would be useful to state that the discharge zones for shoreside facilities very often are valuable and sensitive ecological areas."

Response

The environmental disadvantages of transferring the vessel problem to a shore problem have been recognized in several places in the statement, particularly on pages 60 and 61.

Comment

"The statement should be revised to show that the Environmental Protection Agency is now regulating discharge standards at the terminal at Valdez, Alaska, and that the phrase "zero discharge" is not applicable inasmuch as a daily average discharge of 8 mg/l is being considered."

Response

The phrase "zero discharge" is meant to apply to the ship leg of the oil transported from Alaska and not to the shoreside reception facility. The discussion of shoreside reception facilities has been expanded in this statement at page 47.

Comment

It would be helpful to explain why segregated ballast is most effective when used in tankers carrying crude or residual oil.

Response

The discussion of segregated ballast effectiveness on pages 61 and 62 of the statement contains such an explanation.

Comment

"Double bottom construction should be given a complete evaluation as an alternative either here or on page 35. We strongly recommend that the economic and safety aspects of this alternative be explored completely and presented in the final statement."

Response

The statement has been revised to include the environmental, economic and safety aspects of double bottom construction. These discussions are on pages 72-76 of the statement.

Comment

The legal, social, economic and pollution control efficiency of a U.S. imposed restriction on foreign vessels not meeting construction and safety standards could be explored as an alternative.

Response

Since the scope of the regulations is U.S. seagoing tank vessels in domestic trade, the Coast Guard does not feel that the above alternative is possible. In subsequent regulations when dealing with U.S. vessels in foreign trade and foreign vessels in U.S. waters, the alternative will be explored.

Comment

The studies done by the National Oceanic and Atmospheric Administration should be referenced.

Response

The reference to the study commented on has been deleted in the course of revision of the draft EIS. However, a new reference to a report by the National Oceanic and Atmospheric Administration, Department of Commerce, appears on page 35 and in the reference list on page 225.

Form DOT F 1320.1 (1-67)

UNITED STATES GOVERNMENT

DEPARTMENT OF TRANSPORTATION

OFFICE OF THE SECRETARY

Memorandum

DATE: JUL 30 1974

In reply refer to: 53

SUBJECT: Draft Environmental Impact Statement Pursuant to Section 102(2)(C), P.L. 91-190 Proposed Regulations to Implement Port and Water Safety Act of 1972

FROM: Assistant Secretary for Environment, Safety, and Consumer Affairs

TO: Chief, Marine Environmental Protection Division U.S. Coast Guard

This office has reviewed the draft environmental impact statement for proposed regulations to implement the Port and Water Safety Act of 1972. The anticipated effects of the proposed regulations are generally well documented. However, several items appear to deserve more detailed attention in the final statement.

<u>Double Bottoms</u>. In view of the concern expressed by many environmental groups and some members of Congress, the justification for not specifying double bottoms beneath the cargo tank area should be expanded, clarified and more explicitly justified. The rationale that there would be no immediate significant reduction in oil spills if double bottoms were required should be accompanied by discussion of the extent to which oil spills might be prevented as new vessels with double bottoms would be introduced and older vessels retired from service. In addition, the estimate of increased costs that will result from compliance with the regulations as proposed should be accompanied by an estimate of additional capital costs associated with double bottoms, if such were required.

<u>Estimates of Quantities of Marine Oil Pollution</u>. While Table III-B-1 is useful for background purposes, the continuing citation of an estimate that 52% of the ocean oil influx is attributable to non-marine sources, with emphasis on automobile crankcase oil, lends an aura of accuracy far greater than would appear to be warranted by the assumptions which were used as the basis for the calculations from which this Table is derived. There should be some discussion of the relatively loose assumptions that were made in estimating non-marine sources of oil pollution to the oceans, particularly with respect to crankcase oil.

Different Mode of Transportation for Oil. We question whether this option merits discussion as an alternative to the proposed regulations and suggest that deletion be considered. If it is retained, the last sentence of the present section should be deleted.

We appreciate the opportunity to comment on this draft environmental impact statement. We look forward to receiving the final statement, including a summary of the public hearings and responses submitted by other government agencies.

Ben Davis

Benjamin O. Davis, Jr.

Response to Department of Transportation

Comments contained in memo dated 30 July 1975

Comment

The justification for not specifying double bottoms should be expanded, clarified and more explicitly justified. An estimate of increased costs resulting from compliance with regulations should also be added.

Response

This has been done. See pages 5 thru 9 and 72-76. Economic impact is discussed on pages 53-57.

Comment

There should be some discussion of the relatively base assumptions that were made in estimating non-marine sources of oil pollution to the oceans, particularly with respect to crankcase oil.

Response

Reference to crankcase oil has been eliminated. Information on oil inputs in Table 1 (page 27) has been taken from National Academy of Sciences' report Petroleum in the Marine Environment.

Comment

Does using a different mode of transportation for oil merit discussion as an alternative to the proposed regulations?

Response

Only in the interests of completeness; it really cannot be considered a serious alternative and the discussion on page 82 has been revised to reflect this opinion.

CENTER
FOR
LAW
AND
SOCIAL
POLICY

August 19, 1974

Captain Richard Brooks
Executive Secretary
Marine Safety Council (G-CMC/82)
United States Coast Guard
Washington, D.C. 20590

Captain Sidney A. Wallace
Chief, Marine Environmental
  Protection Division
United States Coast Guard (G-WEP/73)
Washington, D.C. 20590

Proposed Rules for Protection of the
Marine Environment
(CGD 74-32 and CGD 74-77)

Dear Captain Brooks and Captain Wallace:

I am writing on behalf of the Sierra Club, the Environmental Defense Fund ("EDF"), the Natural Resources Defense Council ("NRDC"), the National Parks and Conservation Association ("NPCA"), Friends of the Earth ("FOE"), the National Wildlife Federation ("NWF"), The Wilderness Society, and the National Audubon Society (the "environmental groups") to present their views with respect to the rules and regulations for protection of the marine environment set forth in the Notice of Proposed Rule Making Regarding Tank Vessels Engaged in Domestic Trade (CGD 74-32) and the Advance Notice of Proposed Rule Making Regarding Marine Traffic Requirements (CGD 74-77), both issued on June 28, 1974 (39 Fed. Reg. 24150-24159) (the "proposed rules"). This letter will also serve as a vehicle for

comments of the environmental groups on the adequacy under the National Environmental Policy Act of 1969, Pub. L. No. 91-190, 83 Stat., 852, 42 U.S.C. §§ 4321 et seq. ("NEPA") of the draft environmental impact statement on the proposed rules issued June 28, 1974 (E.L.R. Order No. 41064) (the "Draft Impact Statement"). I have acted as counsel to these groups on environmental matters in the past, and have been asked by them to coordinate the presentation of their views on the important issues of national environmental policy raised by the Coast Guard's proposals.

The environmental groups are all national, non-profit membership organizations deeply concerned and knowledgeable about the preservation and protection of the marine and coastal environment. Their combined membership, which exceeds 2,250,000 persons throughout the United States and abroad, includes a substantial number of persons who reside in coastal areas which are likely to be directly affected by oil pollution, as well as scientists who have conducted and intend to continue to engage in research in coastal and estuarine areas and the marine environment.1/

The Sierra Club, whose principal place of business is at 220 Bush St., San Francisco, Calif. 94104, has a membership of approximately 150,000 persons. EDF, whose principal place of business is 162 Old Town Road, East Setauket, New York 11733, has a membership of approximately 40,000 persons and a 700 member Scientists' Advisory Committee. NRDC, whose principal office is at 15 West 44th St., New York, N.Y. 10035, and has additional offices in Washington, D.C. and

[footnote continued on next page]

The environmental groups have taken an active role over the past several years in the debate surrounding the development of environmental standards for the design and operation of oil carrying vessels. For example, EDF, NRDC and NPCA were plaintiffs in a litigation brought in October, 1972, seeking to have the Federal Maritime Administration ("MarAd") prepare environmental impact statements in connection with its program to subsidize the construction of United States oil tankers, and they provided extensive commentary on the program impact statement which was prepared as a result of the settlement of that litigation.2/ The Wilderness Society, FOE, and EDF were plaintiffs in the litigation challenging the adequacy of the Department of the Interior's environmental impact statement for the Trans-Alaska Pipeline

[footnote continued from previous page]

Palo Alto, Calif., has a membership of approximately 21,000 persons. NPCA, whose principal office is 1701 18th St., N.W., Washington, D.C. 20009, has a membership of approximately 45,000 persons. FOE, whose principal place of business is 1412 16th St., N.W., Washington, D.C. 20036, is composed of associate members and members of state affiliate member organizations, comprising over 2,000,000 persons. The Wilderness Society, which has its principal office at 1901 Pennsylvania Avenue, N.W., Washington, D.C. 20006, and a field office in Denver, Colo., has a membership of about 90,000 persons. The National Audubon Society, which has its principal office at 950 Third Ave., New York, N.Y. 10022, has a membership of more than 325,000 persons.

2/ See Federal Maritime Administration, Final Environmental Impact Statement on Tanker Construction Program (N.T.I.S. Rep. No. EIS 730725-F) (the "MarAd EIS")

and its related marine transportation systems.

In the area of international regulation of marine pollution, EDF, NRDC, NPCA, FOE, and the Sierra Club took a vigorous role in commenting upon the proposed 1973 International Convention for the Prevention of Pollution from Ships (the "1973 IMCO Convention"), prepared under the auspices of the Intergovernmental Maritime Consultative Organization ("IMCO"), and a representative of these groups was a member of the United States delegation to the Conference at which this Convention was negotiated. Many of the groups have also been involved with preparations for the Third United Nations Law of the Sea Conference, including such diverse activities as attending meetings of the Secretary of State's Advisory Committee on the Law of the Sea, submitting comments on U.S. positions and the draft environmental impact statement, and attending the Conference in Caracas.

In particular, the environmental groups have been involved since its inception with the development and administration of the Ports and Waterways Safety Act of 1972, Pub. L. No. 92-340, 86 Stat. 424 (the "Act") -- the authority for the rules and regulations under consideration here. EDF and the Sierra Club submitted comments to the Senate Commerce Committee when the Act was introduced in the fall of 1971. All of the groups responded to the Coast Guard's original Advance Notice of Proposed Rule

Making (38 Fed. Reg. 2467 [January 26, 1973]) (the "original proposal") and submitted comments to the Coast Guard in March 1973, with respect to its tanker construction standard proposals. All of the groups, with the exception of the National Audubon Society, testified last summer on the original proposal before the Subcommiteee on Coast Guard and Navigation of the House Committee on Merchant Marine and Fisheries. And, over the past year, their interest has been reflected in numerous communications with responsible public officials, including most recently, testimony given July 31 at the public hearing held in Washington, D.C. on the proposed rules.3/

3/ With the permission of the Coast Guard, I would like to incorporate by reference in these comments the following documents in which our views are expressed:

(a) Letter, dated March 15, 1973, on behalf of EDF, NRDC, NPCA, the Sierra Club, FOE, NWF, and The Wilderness Society, to the Coast Guard regarding the Advance Notice of Proposed Rule Making (CGS 72-245P);

(b) Testimony, dated June 28, 1973, before the Subcommittee on Oceans and Atmosphere of the Senate Commerce Committee, on behalf of EDF, NRDC, NPCA, the Sierra Club, and FOE, with regard to the 1973 IMCO Convention;

(c) Letter, dated June 29, 1973, on behalf of EDF, NRDC, NPCA, the Sierra Club, and FOE, to the United States National Committee on Marine Pollution, with regard to the 1973 IMCO Convention;

(d) Testimony, dated July 19, 1974, before the Subcommittee on Coast Guard and Navigation of the House Committee on Merchant Marine and Fisheries, on behalf of the Sierra Club, EDF, NRDC, NPCA, FOE, NWF, and The Wilderness Society, with regard to proposed tanker construction standards;

[footnote continued on next page]

We have from the inception of this debate seen our role as supportive of rather than in opposition to government initiatives in the area of tanker design and operation, on the grounds that the initiatives taken represented a choice in favor of stringent, forward looking environmental controls. In our Congressional testimony last summer, we

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[footnote continued from previous page]

(e) Letter, dated August 6, 1973, on behalf of EDF, NRDC, NPCA, the Sierra Club, FOE, NWF, and The Wilderness Society to the Coast Guard with regard to its withdrawal of the original proposal;

(f) Letter, dated October 2, 1973, on behalf of the Sierra Club, EDF, NRDC, NPCA, and FOE to the Coast Guard with regard to the draft environmental impact statement on the 1973 IMCO Convention (N.T.I.S. Order No. EIS 73-1391-D) (the "IMCO EIS");

(g) Letter, dated December 28, 1973, on behalf of The Wilderness Society, FOE, and EDF to Hon. Rogers C.B. Morton, with regard to proposed tanker construction standards; and

(h) Letter, dated June 13, 1974, on behalf of all the environmental groups to Hon. Claude Brinegar, with regard to proposed tanker construction standards.

Additionally, I would refer the Coast Guard to the comments of Richard L. Storch on the MarAd EIS (at G-223 through G-243), and to my extended oral testimony before the Subcommittee on Coast Guard and Navigation last summer (see Hearings on Tanker Construction Before the Subcommittee on Coast Guard and Navigation of the House Committee on Merchant Marine and Fisheries, 93d Cong., 1st Sess. 237-272 (Serial No. 93-16) (June 6, 7, July 18, 19, 1973) [hereinafter cited as "House Oversight Hearings"]).

If the Coast Guard is not in possession of any of the above-mentioned documents, I would be most happy to supply them for the record.

applauded the original proposal to require incorporation on oil carrying vessels trading in United States navigable waters of a segregated ballast capacity of not less than 45% of full load displacement, achieved in part through utilization of a double bottom of a minimum height of 1/15th of the beam, as "one of the most important efforts to date by any governmental agency to deal constructively and forthrightly with the growing threat posed by the marine transport of oil to coastal and marine ecosystems."4/ It was thus with increasing dismay that we watched the months roll by after conclusion of the IMCO Conference with no proposed standards being published, even though the Act, as amended by Section 401 of the Trans-Alaska Pipeline Act of 1973, Pub. L. No. 93-153, required the issuance of rules and regulations governing tanker design "effective not later than June 30, 1974, with respect to United States

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4/ House Oversight Hearings at 238. The environmental groups were not alone in their support. Not surprisingly, public support for the Coast Guard's original proposal from state and local governments concerned over the need to protect this country's coastal and marine resources, from national and local environmental groups and from individual citizens was widespread. Among those expressing such support, in addition to the environmental groups, were the States of Connecticut, Delaware, Maine, and Maryland, the City of Boston, the Cape May Planning Board, and the Oceanographic Commission of Washington. Twenty-eight of the comments submitted to the Coast Guard endorsed the segregated ballast/double bottom concept, while only 13 opposed, and support came as well from shipowners, shipbuilders, and naval architects. See House Oversight Hearings at 12.

flag vessels engaged in coastwise trade". We feared -- it now appears justifiably -- that this delay signalled a retreat, in particular, from the Government's support for the segregated ballast/double bottom standard, a standard which is especially of vital importance for protecting the delicate marine resources which may be imperiled by the tanker trade between the Port of Valdez and the West Coast.5/

The proposed rules, published on June 28, just two days before the statutory deadline for promulgating final regulations, confirmed those fears. While the proposed rules do contain much that is valuable for protection of our marine and coastal environment and would undoubtedly bring about environmental improvement, they simply do not go far enough toward achieving the goal to which the United States (and other nations) are committed: "the complete elimination of intentional pollution by oil and other harmful substances and the minimization of accidental discharges of such substances ... by 1975, if possible, but certainly by the end of the decade." 6/ Moreover, as far as the marine

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5/ For a general discussion of the nature of these ecosystems and the means available to protect them, see Final Environmental Impact Statement on Proposed Trans-Alaska Pipeline, prepared by the Department of the Interior (N.T.I.S. Order No. EIS 72-4034-F, filed March 2, 1972); see also Boesch, Hershner and Milgram, Oil Spills and the Marine Environment (Ford Foundation Energy Policy Project, June 1974), where the authors note that the effects of oil spilled in polar regions may be particularly serious and long lasting, because natural degradation processes are slow in cold waters and because arctic creatures are slow to reproduce.

6/ IMCO Assembly Resolution A.237(VII) (October 12, 1971).

transport leg of the Trans-Alaska Pipeline is concerned, they represent a reversal of the commitment made to both Congress and environmental groups by the Secretary of the Interior that oil tankers serving the Pipeline would incorporate, among other features, segregated ballast/ double bottom systems.7/ Indeed, by merely adopting the standards of the 1973 IMCO Convention for our domestic trade -- which is in essence all they do -- supplemented by certain traffic control, equipment and manning requirements, they represent an inexplicable and unjustifiable abandonment of the Coast Guard's previous and well-founded commitment to the highest standards of environment protection. They also undercut the adoption by many American tanker owners and operators of new, higher standards, such

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7/ In testimony before the Joint Economic Committee on June 22, 1972, Secretary Rogers C.B. Morton explicitly stated:

> "newly constructed American flag vessels carrying oil from Port Valdez to United States ports will be required to have segregated ballast systems, incorporating a double bottom, which will avoid the necessity for discharging oily ballast to the onshore treatment facility."

In the same testimony, he also promised that new tankers would "be evaluated looking toward improving their maneuverability with regard to stopping distance and turning characteristics."

as double bottoms, and will undoubtedly have the unfortunate effect of discouraging future incorporation of these environmentally sound design features.

It goes without saying that because of the grave potential dangers of oil pollution to ocean ecosystems, "great caution" must be followed in making policy decisions with regard to protection of the marine environment.8/ We believe that the means are available now to carry out such a cautionary approach and achieve substantial gains in oil pollution prevention and control. As set forth in greater detail below, many features which may provide for increased maneuverability or reduction of accidental outflows have been employed on tank vessels for a number of years. The demand for additional design and construction requirements does not then involve "pie in the sky" research and development projects, only likely to

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8/ See, e.g., Boesch, Hershner and Milgram, Oil Spills and the Marine Environment (Ford Foundation Energy Policy Project, June 1974). It should be noted in this regard that the Draft Impact Statement's observation, at page 51, that "no agreement has been reached on that quantity of hydrocarbons which the oceans can assimilate," tends to create a false sense of security about these issues. The point is that the oceans are a finite ecosystem and there are limits on the amount of hydrocarbons which can be assimilated. Oil pollution has profoundly affected the marine environment, and this pollution appears to be growing. See Butler, Morris and Sass, Pelagic Tar From Bermuda and the Sargasso Sea (1973). Maximum efforts, therefore, must be made to eliminate it.

result in concrete proposals some years hence, but the application of technical capabilities which we now have and which the more environmentally concerned tanker owners are, on their own initiative, using. Such requirements can and should be required of tank vessels engaged in domestic trade and non-complying vessels must be excluded from such trade after an appropriate period of time. If such action is not taken because of some vague allegiance to lower, non-binding international standards, then the wisdom of our commitment to developing vessel source pollution standards in the international forum must be questioned. 9/

(a) Misinterpretation of Statutory Requirements

At the outset, it is important to take issue with a basic and erroneous premise on which the Coast Guard seems to be operating. The Coast Guard appears to take the view that the Act requires it to establish identical standards for U.S. flag vessels engaged in coastwise trade and those

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9/ There is, it might be noted, considerable Congressional sentiment on this issue. Indeed, the Senate Commerce Committee, in its Report on the Energy Transportation Security Act of 1974, has already concluded, "[I]f our country is in fact going to preserve and protect its marine environment, then it will have to act unilaterally, since the rest of the world's maritime nations apparently are unwilling to adopt strict standards." Report of the Senate Comm. on Commerce on H.R. 8193, 93d Cong., 2d Sess. 21 (Rep. No. 93-1031) (July 25, 1974). See also Statement of Representative Edward Koch (D.-N.Y.) on the regulation of oil tankers. 120 Cong. Rec. H. 7551-7552 (August 1, 1974).

engaged in foreign trade. Its proposed rules state:

> "Section 4417a of the Revised Statutes of the United States (46. U.S.C. 391a) prior to its amendment by the Ports and Waterways Safety Act of 1972 applied to all vessels carrying inflammable or combustible liquid cargo in bulk, except public vessels owned by the United States. Section 7(D) of section 201 specifies that any rule or regulation for the protection of the marine environment promulgated pursuant to subsection (7) must be equally applicable to U.S. flag vessels engaged in foreign trade and to foreign vessels. Since there was no provision in 46 U.S.C. 391a authorizing any distinction in treatment between U.S. vessels engaged in foreign trade and U.S. vessels engaged in the coastwise trade, nor any provision authorizing any distinction in treatment between U.S. vessels and foreign vessels, it is clear that the intent of the Congress in subsection 7(D) was to assure in the implementation of subsection 7(C) that no distinction of treatment between U.S. and foreign vessels be inferred from any treaty, convention, or international agreement. Section 401 of the Act of November 16, 1973, introduced the first distinction in treatment of U.S. vessels under the Ports and Waterways Safety Act of 1972, accelerating the date for promulgation of certain regulations for U.S. vessels engaged in the coastwise trade, and allowing the regulations for U.S. vessels engaged in the foreign trade and foreign vessels to be published at a later time. Accordingly, the regulations proposed in this document apply to U.S vessels engaged in trade other than the foreign trade. Since these proposed regulations are consistent with both the International Convention for Prevention of Pollution from Ships, 1973, and current domestic law, the regulations are proposed as interim regulations until that time prior to January 1, 1976, when regulations for U.S. vessels in foreign trade and foreign vessels entering U.S. waters will be effective."10/

While the logic of this statement is somewhat difficult to follow, its thrust appears to be that the Act only authorizes uniform standards for all U.S. flag vessels. This novel

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10/ 39 Fed. Reg. 24151.

view represents a misinterpretation of the Congressional intent. Nothing in the Act requires that identical standards be established for coastwise and international trade. Indeed, a number of regulatory schemes, including different schemes for different segments of our coastwise trade, are possible in order to achieve the Act's goals of providing protection for our marine and coastal environment.11/ The Act is permissive in nature, and contains no prohibition of selective standards for different trades.

Congress was concerned, of course, that unilateral standards affecting U.S. flag vessels engaged in U.S.-foreign trade but not foreign vessels engaged in such trade would place our vessels at a competitive disadvantage and untimately be environmentally counterproductive. Thus, Section 7(D) of the Act requires that rules and regulations must be "equally applicable to foreign vessels and United States flag vessels operating in foreign trade". The purpose of this section was not to require uniform standards for all U.S. flag vessels but to protect those U.S. flag vessels which must compete in foreign commerce against foreign bottoms. Indeed, the fact that the section specifically refers to "United States flag vessels operating in foreign trade" (emphasis added) and not to United States flag vessels

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11/ The Coast Guard, in its Advance Notice of Proposed Rulemaking regarding Marine Traffic Requirements (CGD 74-77), appears implicitly to recognize this, insofar as it would permit Port Captains to vary traffic system requirements depending upon the hazards associated with particular areas. Proposal 1, 39 Fed. Reg. 24158.

generally would seem to be conclusive of this interpretation, for it clearly leaves open the possibility of treating vessels operating in coastwise trade differently. As Senator Warren Magnuson, Chairman of the Committee responsible for the Act in the Senate, simply put it at the Seattle public hearings on the proposed rules: "Mandatory similar treatment of all U.S. flag vessels, whether they operate in the domestic or foreign trade, was not the clear intent of Congress."12/

In point of fact, different considerations may apply to coastwise trade, Coastwise trade is protected under 46 U.S.C. §883 from competition by foreign flag vessels. Any increased costs of construction or operation which may result from the imposition of stringent anti-pollution controls on coastwise vessels thus cannot disadvantage their competitive position.13/ The distinction was explicitly noted in the Senate Report on the Act, S. Rep. No. 92-724, 92nd Cong., 2d. Sess., 1972 U.S. Code, Cong. and Ad. News 2886 (hereinafter cited as the "Senate Report"), where, after discussing the need for uniform application to all vessels engaged in U.S.-foreign commerce, it is stated, "Of course, the same rationale does not apply to United States flag vessels operating in

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12/ Statement of Hon. Warren Magnuson before the Department of Transportation with respect to the proposed rules (July 23, 1974).

13/ The Coast Guard itself recognizes this in the Draft Impact Statement where it states, at page 51, "[S]tricter measures [than those embodied in the Convention] would not directly disadvantage the economic position of these vessels when engaged in coastwise trade...."

[footnote continued on next page]

domestic trades in which competition from foreign flag vessels is excluded by law." 14/

Further, whatever rules may eventually be applied to international traffic -- an issue which is not being addressed

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[footnote continued from previous page]

To the extent it might be argued that oil tankers are interchangeable, that tankers trading one trip between New Orleans and Bayonne may be trading the next trip between Aruba and Marcus Hook, and therefore that to impose higher standards domestically would affect the international competitive position of U.S. flag vessels, the short answer is that, because of the generally adverse position of U.S. flag vessels in international trade due to higher construction and operation costs, forays out from coastwise into international trade must, absent subsidy, be exceptional, and tanker owners and operators, in consideration of their protected coastwise trade, must pay the penalty for the exceptional trip through meeting higher pollution abatement standards. Furthermore, as statistics for tanker traffic in the year 1970 (the last year in which full information is available) reveal, U.S. tanker carriage of petroleum imports has amounted on an overall statistical average to less than 5% of total U.S. flag tanker fleet operations. See generally Optimum Computer Systems, Inc., report to the United States Coast Guard, Analysis of Coastal Tank Vessel and Barge Traffic (April 1973); Sun Oil Company, Analysis of the World Tanker Fleet, December, 1970; Heine, The Growing Energy Crisis and the U.S. Tanker Fleet, a report to the Labor-Management Maritime Committee (December 1971). The effect, then, of adopting only international standards for coastwise traffic would be to lower the environmental safety characteristics of U.S. flag tankers in more than 95% of their operations for the sake of protecting what is at best a marginally competitive position on a small proportion of our international commerce. This simply makes no sense as a matter of sound public policy.

14/ Senate Report at 2909.

at this time 15/ -- there is an environmental justification for applying higher standards to coastal traffic. Coastal tankers will tend to spend more time in ecologically sensitive waters. Thus ballasting operations may seriously damage the environment, even if low effluent levels can be achieved. Moreover, the risks of groundings and collisions are especially high for smaller coastal tankers which often enter into narrow, shallow and crowded harbors. Special attention must necessarily be given to their maneuverability characteristics and to means to prevent or reduce outflow should accidents occur. Under such circumstances, it is manifestly unsound, from an environmental perspective, to consider that uniform standards must be applied to all tank vessels trading in U.S. navigable waters.

(b) The Problem of "Grandfather Rights"

A second major difficulty with the Coast Guard's approach to the implementation of the Act involves the creation of "grandfather" rights which will insure that the risks of pollution of our coastal waters will remain high for years to come. Under the proposed rules, certain critical requirements, most importantly that of segregated ballast for

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15/ It should be noted, in this connection, that the implicit conclusion embodied in the proposed rules and stated explicitly in the Draft Impact Statement (at page 1) that "no substantive changes are anticipated" for rules regarding international trade represents the kind of prejudgment which is wholly inappropriate at this time. Rather, an independent assessment of whether higher U.S. standards should be required of international traffic must be made when such rules are actually under consideration. And, if the Coast Guard adheres to its view that all U.S. tankers must be treated uniformly, then there may be an even stronger incentive to opt for standards higher than those of the 1973 IMCO Convention for all vessels. In any event, we would urge the Coast Guard to promulgate such rules as soon as possible and certainly not as late as the statutory deadline of January 1, 1976. Indeed, with the signing of the 1973 IMCO Convention, there seems little reason to wait.

vessels of 70,000 deadweight tons or more, need only be met by a "new vessel", defined in Section 157.03(i) as a vessel that:

"(1) Is constructed under a contract awarded after December 31, 1974;
(2) In the absence of a building contract, has the keel laid or is at a similar stage of construction after June 30, 1975;
(3) Is delivered after December 31, 1977; or
(4) Has undergone a major conversion for which --
(i) The contract is awarded after December 31, 1974;
(ii) In the absence of a contract, conversion is begun after June 30, 1975; or
(iii) Conversion is completed after December 31, 1977."

While dates chosen to define "new vessel" represent an improvement over the dates of the 1973 IMCO Convention, 16/ the effect of the proposal is to let all "existing ships" (defined in Section 157.03(j) as any vessel other than a "new vessel") escape these requirements forever. Nothing in the Act requires the Coast Guard to limit the proposed

16/ The 1973 IMCO Convention, in Annex I, Regulation 1(6), defines a new vessel as one

"(a) for which the building contract is placed after 31 December 1975; or

(b) in the absence of a building contract, the keel of which is laid or which is at a similar stage of construction after 30 June 1976; or

(c) the delivery of which is after 31 December 1979; or

(d) which has undergone a major conversion:

(i) for which the contract is placed after 31 December 1975; or

(ii) in the absence of a contract, the construction work of which is begun after 30 June 1976; or

(iii) which is completed after 31 December 1979."

requirements in such fashion. Indeed, the Senate Commerce Committee considered and rejected the legislative creation of such "grandfather rights" which, it was felt, would defeat the basic environmental protective purposes of the legislation. In so doing, the Committee reasoned:

> "Providing strict 'grand-father rights' [would]... become an artificial incentive for tanker operators to use their oldest and worst tonnage in United States trade in the knowledge that regulations for the protection of the marine environment would not apply." 17/

In a letter dated March 13, 1973, commenting on the original proposal, Senator Magnuson specifically expressed his concern about the prospect of "what would appear to be an absolute grandfather clause". He feared that it might "create an incentive for tanker owners to prolong use of their older and less environmentally desirable tonnage in United States trade". 18/ While the Senate's and Senator Magnuson's concerns were directed primarily at the prospect of older, foreign tonnage being used in U.S.-foreign trade, the same rationale applies to domestic trade, *i.e.*, U.S. tanker owners and operators will have an incentive to prolong the lives of non-complying tonnage in coastwise trade in order to avoid the cost of meeting the stricter requirements. In proposing to limit the segregated ballast (and certain other requirements) to a defined

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17/ *Senate Report* at 2907.

18/ *House Oversight Hearings* at 41.

class of new vessels, the Coast Guard would create the precise type of artificial incentive which Congress sought to avoid.

Even more significantly, the "grandfather rights" approach proposed by the Coast Guard could, as a practical matter, render its requirements for new vessels ineffectual until some time in the 1980s. Recent statistics on the size and future growth of the U.S. tanker fleet show that, as of April 1, 1974, there were 235 tankers in the active, oceangoing fleet, and that 68 tankers were on order or under construction; new building represented approximately 4.6 million deadweight tons to be added to the existing fleet of approximately 8 million deadweight tons.19/ Since April, MarAd has awarded contracts to assist in the construction of seven additional tankers, totalling more than 1.6 million deadweight tons, including three 390,000 deadweight ton vessels, the largest

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19/ United States Department of Commerce, MarAd, Merchant Marine Data Sheet April 1, 1974, MA NR 74-9 (May 14, 1974). Worldwide figures are equally striking. As of May 31, 1974, there was an existing tanker fleet of 3,353 carriers in excess of 10,000 tons, while 1,297 vessels were on order. In terms of tonnage, vessels delivered since 1971 or now on order constituted 67% of the existing and currently planned fleet. See Shipping Statistics and Economics, published by H.P. Drewey (Shipping Consultants) Ltd., London, No. 44 (June 1974).

ever to be built in a U.S. shipyard.20/ Vessels now under contract thus represent a 30% increase in the size and a more than a 75% increase in the tonnage of the U.S. flag tanker fleet. None of these "new" vessels, of course, will be considered "new" under the proposed rules, and it goes without saying that a large number of such vessels will not incorporate segregated ballast/double bottom systems or other design features which might be required of future tankers.21/ The Coast Guard's proposal would leave this greatly expanded fleet of new oil carrying vessels, with useful lives of 20 years, free to engage in U.S. coastwise trade without meeting stringent pollution control requirements. As is recognized in the Draft Impact Statement at page 55, the effect of this approach would be effectively to nullify even the "residual benefits" of the new construction standards until the "middle 1980s".

20/ See United States Department of Commerce News, MA NR 74-14 (June 12, 1974); MA NR 74-17 (June 29, 1974). While vessels receiving construction-differential subsidies from MarAd in theory must operate exclusively in foreign commerce, see 46 U.S.C. §1151(a), they may elect to engage in costwise trade, subject to paying as a penalty to MarAd a proportion of the difference between the domestic and foreign costs of such vessels, 46 U.S.C. §1156, 46 C.F.R. §276.1, and, it seems apparent that taking such a penalty may be economically advantageous in many instances to allow tanker owners and operators to pick up lucratic domestic business such as that which will be represented by the Trans-Alaska Pipeline trade.

21/ Many of the vessels undoubtedly will be used in the marine transport leg of the Trans-Alaska Pipeline. Unfortunately, the Draft Impact Statement provides no data with respect to this matter, although clearly in evaluating the effectiveness of the Coast Guard's requirements for new ships on the Alaskan trade (as well as on other trades) it is necessary to know how many ships will be covered by (and how many will escape) such requirements.

In light of the problems raised by grandfather rights, but also recognizing the need for some grace period to allow for orderly adjustment to new design criteria, we reiterate the recommendation that we have made in the past that the Coast Guard establish an absolute cut-off date perhaps after some progressive phase-out period, within the near future after which no oil carrying vessel -- regardless of its contract, construction or delivery date -- would be permitted to engage in coastwise trade unless it met the requirements for new tank vessels.

(c) Adequacy of Proposed Standards

In Title II of the Act, Congress laid down a mandate to the Coast Guard to come up with new vessel design and construction standards in at least three basic areas: (1) maneuverability and stopping ability; (2) reduction of cargo loss following collision, grounding or other accidents; and (3) ballasting and deballasting procedure.22/

22/ Congress, in Section 201(7) of the Act, specifically directed the Coast Guard to establish standards

> "as soon as practicable. . .to improve vessel maneuvering and stopping ability and otherwise reduce the possibility of collision, grounding or other accidents, to reduce cargo loss following collision, grounding or other accidents, and to reduce damage to the marine environment by normal vessel operations, such as ballasting and de-ballasting, cargo handling and other activities."

Other areas in which the Congress suggested that improvements could be made in tanker construction and operation included (a) navigating and cargo handling equipment; (b) electronic safety and anti-collision devices; and (c) adequate detection gauges and alarms during loading and unloading. Senate Report at 2900. We are pleased that the Coast Guard has taken action in at least one area -- electronic safety and anti-collision devices (Proposal 2, 39 Fed. Reg. 24158), and we urge it to take action, as is required by law, in the other areas as well.

In the Senate Report accompanying the Act as well as in the hearings on S. 2074 before the Senate Commerce Committee, 23/ each of these aspects of the mandate was spelled out in detail. Indeed, short of explicitly laying down technical requirements, rarely has Congress drawn up such a clear roadmap for administrative agencies to follow in implementing the Congressional will.24/ For example, after noting the extent to which oil tankers as they have increased in size have tended to become less maneuverable, the Senate Report states that "much more needs to be done in this area", mentioning, in particular, a Coast Guard study concluding that use of lateral thrusters "is recommended for future designs" in order to provide side force to assist in docking and maneuvering25/, and further suggesting that,

> "Standards in this category might include minimum propulsion and particularly reverse propulsion requirements, bow thrusters or lateral thrusters, flaps, or standards might be stated in terms of performance requirements for maneuverability, crash stop ability and directional control ability".26/

With regard to possible methods for dealing with pollution from tanker groundings, the Senate Report cited double

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23/ See Hearings on S. 2074 before Senate Committee on Commerce, 92nd Cong. 1st Sess. (September 22, 23, 24, 1971).

24/ Unfortunately, it might be pointed out, the Draft Impact Statement, except for certain cursory references (i.e., at page 49), utterly fails to give the reader a sense of the Act's objectives and requirements or of the reasons for its enactment.

25/ Senate Report at 2898-2899.

26/ Id. at 2907.

bottoms as "[p]erhaps the clearest instance of a standard presented at the Committee's hearings that must be seriously considered ..."27/, and concluded that "double bottom construction would lessen the likelihood of serious damage to the environment in those instances where groundings do occur."28/ As regards prevention of pollution from deballasting operations, the Committee rejected industry's response to this problem (the load-on-top procedure) as "not an adequate solution"29/, and concluded that "there seems little doubt that the adoption of segregated ballast could contribute significantly to protection of the marine environment ..."30/ Although there is no question that the technology exists to achieve Congressional objectives, almost two years after passage of the Act little of what is dealt with in the Senate Report can be found in the proposed rules.

(1) Maneuverability

Although regulations under Title II of the Act were required to be effective by June 30, 1974, the Coast Guard has not made a single proposal with respect to maneuverability features. The proposed rules merely state that,

> "Research and development of a conceptual vessel maneuvering model is underway in the Coast Guard. This model will integrate vessel variables, port dependent variables, environmental variables and

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27/ Senate Report at 2897.
28/ Id. at 2894.
29/ Id. at 2899.
30/ Id. at 2900.

> human factors. It is premature to conclude that this research will result in standards for vessel maneuvering."31/

This is a totally inadequate response to the plain mandate of the Act. It has been two years since the Act was passed. Congress, as noted above, suggested in 1972 a number of features which might be considered for adoption. Many of these features, e.g., thrusters, controllable pitch propellers, twin screws/twin rudders, have been extensively studied and discussed,32/ involve existing technology, and are available "off the shelf" today. As of July 1973, the worldwide population of controllable pitch propellers built by one manufacturer alone -- KaMeWa of Sweden -- either in service or on order, numbered approximately 2,400, with a total horsepower of about 13,100,000. As of April 1973, 1,300 thrusters built by the same company were in service throughout the world. With regard to oil carriers in particular, as of August 1973, there were 91 in excess of 5,000 deadweight tons (the largest of which are 133,000 deadweight tons) equipped with KaMeWa controllable pitch propellers, while there were 107 tankers, including one tanker, the ESSO DEMENTIA, in excess of 250,000 deadweight tons, equipped

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31/ 39 Fed. Reg. 24152 (emphasis added).

32/ See, e.g., MarAd EIS VI58-VI63; Porricelli, Keith and Storch, Tankers and the Ecology, paper presented at the annual meeting of the Society of Naval Architects and Marine Engineers (November 1971); Proceedings of the Panel Discussion on Environmental Protection and Tanker Design for the Intersociety Conference on Transportation, Denver, Colorado (September 25, 1973); Norrby, A Study of Crash Stop Tests with Single Screw Ships (1972).

with lateral thrusters built by such company.33/ Many U.S. tankers, it should be pointed out, have incorporated these features. As of June 28, 1974, sixteen controllable pitch propellers and 31 lateral thrusters had been delivered for the U.S. tank vessel fleet by Bird Johnson Company, the U.S. licensee of KaMeWa.34/

Operational experience with these features has thus been extensive -- literally millions of hours -- and seems to have proven that there are both economic and pollution control benefits in their incorporation. Moreover, they may have particular benefits on coastwise tankers. Controllable pitch propellers, to take just one example, have been estimated by MarAd to provide a 25% reduction in straight line stopping distance, a capability which is "most valuable in coastal and harbor situations where maneuverability is restricted."35/ This capability, needless to say, might also prove useful on tankers loaded with Alaskan oil navigating the treacherous Straits of Juan de Fuca. There is therefore need for such features to be required on coastwise tankers, and the failure of the Coast Guard even to consider them at this time is mystifying.

33/ This data is derived from the report entitled "Current Status of Controllable Pitch Propeller and Lateral Thruster Systems and Installations," published by Bird-Johnson Company, August 15, 1973.

Twin screw/twin rudder systems which provide increased turning moment, it might be pointed out, in addition to commonly being employed on military and passenger vessels, have also been used on tank vessels. For example, Gulf Oil Corporation's six 326,000 deadweight ton Universe class VLCC's all were constructed with this feature.

34/ Bird Johnson Company, Delivery Lists, June 28, 1974.

35/ MarAd EIS at VI-63-VI-64.

(2) Reduction of Operational and Accidental Outflows

It is convenient to deal with the twin problems of reducing accidental and reducing operational outflows together to some extent. Consonant with the "systems approach" which Congress stressed so heavily in drafting the Act, 36/ the environmental groups believe that the Coast Guard has built over the past several years an unassailable case in favor of constructing new tank vessels with a segregated ballast/double bottom system -- a "systems approach" designed to help reduce simultaneously operational and accidental pollution -- and that the most critical failure of the Coast Guard in the proposed rules is to mandate such a system for the maximum practicable span of coastwise tankers. Incorporation of a double bottom on a vessel provides not only a means of preventing accidental pollution (see pages 36 to 42, *infra*), but a means of achieving part of the segregated ballast capacity needed to obtain optimum operational pollution benefits. There are any number of designs which can be considered for a segregated ballast tanker37/, but Coast Guard studies on this subject have demonstrated beyond cavil, as stated in the IMCO EIS at 50, "In terms of segregated ballast designs studied, the double bottom design is clearly the most cost effective when both

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36/ See Senate Report at 2897.

37/ Eight different designs for a 250,000 deadweight ton tanker were the subject of the Coast Guard's studies in the area. See United States Coast Guard, Report on Part of Study I, Segregated Ballast Tankers (June 1972).

operational and accidental pollution are considered."38/

Coast Guard studies, prepared in developing the United States positions for presentation to the 1973 IMCO Conference, concluded that the environmental benefits of the segregated ballast/double bottom system were as follows:

1. Operational pollution reduced 95%.
2. Accidental pollution reduced 35%.
3. Total pollution reduced 67%. 39/

The same studies, as described in the IMCO EIS, also showed that "[S]egregated ballast was economically viable aboard tankers of 20,000 DWT or greater."40/ And for its part, the President's Council on Environmental Quality, after an extensive study of the risks of oil pollution on the Outer Continental Shelf, specifically recommended to the Coast Guard that it require "new tankers in the U.S. coastal trade (which would include the tankers used to carry OCS oil to shore) to be constructed with segregated ballast capacity with double bottoms where ship safety would not be jeopardized". 41/

38/ Admiral Rea, former Chief of the Office of Merchant Marine Safety of the Coast Guard, expressed the same view in congressional hearings last summer. See House Oversight Hearings at 7-8.

39/ Segregated Ballast Tankers Employing Double Bottoms, supporting document to D.E. VIII/12 and M.P. XIV/(c), presented to IMCO by the United States of America (November 1972); United States Coast Guard, Reports on Parts 1 and 2 of Study I, Segregated Ballast Tankers (June 1972 and February 1973).

40/ IMCO EIS at 50.

41/ President's Council on Environmental Quality, OCS Oil and Gas - An Environmental Assessment 1-28 (April 4, 1974).

In spite of these conclusions and recommendations, the proposed rules only call for segregated ballast on tankers larger than 70,000 deadweight tons (Section 157.09) and make no provision for double bottoms. This result is inexplicable and, in our view, wholly unjustifiable.

A. Reduction of Operational Outflows

There is no question that the most effective way to "reduce damage to the marine environment by normal vessel operations such as ballasting and deballasting" is to require the use of segregated ballast systems on the maximum practicable span of oil carrying vessels.42/ As the Coast Guard concluded less than one year ago,

> "At this point in time, segregated ballast tanks appear to be the most viable solution to the problem of ballasting tankers while meeting environmental protection needs. It also appears that this solution will remain valid in the forseeable future."43/

The inherent limitations of the so-called load-on-top procedure as an alternative to segregated ballast are well known.44/ In particular, it is ineffective on

42/ With respect to the operational effluent problems, it also bears mention that although fixed, high capacity cleaning systems using recirculating wash water, coupled with adequate safety measures, such as a gas inerting system, may substantially reduce effluent content (See MarAd EIS at VI71-VI72), the Coast Guard has made no proposals at all in the area of tank cleaning systems or flue gas inerting, nor, as far as appears from the Draft Impact Statement, has it considered such a possibility.

43/ IMCO EIS at 50.

44/ See, e.g., Senate Report at 2899; MarAd EIS at IV-11; Draft Impact Statement at 31; Porricelli, Keith and Storch, Tankers and the Ecology, paper presented at the annual meeting of the Society of Naval Architects and Marine Engineers (November 1971).

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short ballast voyages or on tankers in the oil product trade. Because coastal trips tend to be short, i.e., on the order of three to five days, and because many coastal tankers primarily carry refined products, it is then least useful in coastwise trade.45/ This ineffectiveness is

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In this regard, it should be noted that the impact of improvements in load-on-top procedure, i.e., the requirements that "an oil discharge monitoring and control system approved by the Coast Guard" be installed on coastwise tankers (Section 157.37 (a) (5)), is far from clear. The Draft Impact Statement nowhere discusses the effectiveness of such systems, their cost, the current state of the art, or, indeed, the improvement they represent over existing practice. The conclusion (on page 37 of the Draft Impact Statement) that "this equipment will be an effective method of reducing significantly the oil discharge from this source", is thus factually unsupported, and it is particularly inappropriate where the Coast Guard itself has not yet even proposed standards for such equipment and where there is no indication when such proposals will be made, yet alone become effective.

45/ It should be pointed out that there is no question that tankers in the product trade can employ a segregated ballast system economically. Presently, for example, six such tankers of 35,000 deadweight tons each are being built for Standard Oil Company of California (Chevron) by FMC Corporation's Marine and Rail Division (formerly Gunderson, Inc.) in Portland, Oregon. See "Pollution Free Tankers Use Gas Turbine Propulsion", Gas Turbine International, March, April 1973, at 40. While such a requirement may force more of these tankers into dedicated trades (to avoid the necessity of washing all cargo tanks on each ballast voyage) this seems a small price to pay for the substantial pollution control benefits.

In any event, it should be pointed out that there may be an increasing growth in coastal crude trade, not just for the Trans-Alaska Pipeline, but from possible exploitation of the Alaskan and Atlantic Outer Continental Shelf. Thus, the Draft

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magnified, moreover, in what will become the major North American crude trade from Valdez to the West Coast where adverse weather conditions may impede the separation process. Thus application of the segregated ballast requirement to smaller tankers engaged in that trade would appear to be environmentally mandated.

The absence of a broader segregated ballast requirement to stem the operational pollution problem is particularly disturbing when considered in connection with the discharge

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Impact Statement's conclusion (at page 41) that "in the future U.S. interterritorial shipments of crude oil by vessels will be minimal, with the exception of the Trans-Alaska Pipeline shipments", may be incorrect, and the relative percentage of crude and product carriers in the coastal trade may change substantially.

In light of these considerations, the flat assertions, with no supporting data, in the Draft Impact Statement (at page 5) that "the economic consequences of the alternative [segregated ballast for all tankers] for the U.S. tank fleet are unreasonable" and that its "benefit would be minimal" simply cannot be accepted.

criteria embodied in Section 157.37.46/ In the first place, we would question whether these criteria are sufficient to protect the marine environment. The environmental basis for these limitations is far from clear -- indeed it is nowhere stated in the Draft Impact Statement how these limitations were arrived at or what the biological or long term accumulative impact of such discharge levels is -- and they appear to do little more than codify existing outflow standards which are already met on the 75% of existing tonnage which utilize the load-on-top procedure. Outflows, moreover, will be substantial. To permit discharges of oil from oil tankers at a rate of 60 litres per mile and in a quantity as much as 1/15,000 of the cargo for existing tankers and 1/30,000 of the cargo for new tankers would permit discharges at a rate of 15,750 gallons per 1,000 mile voyage, or as much

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46/ Under such criteria,

"... the discharge into sea of an oily mixture from a cargo tank and cargo pump room bilges of a vessel is prohibited unless the vessel --

(1) Is more than 50 nautical miles from the nearest land;

(2) Is proceeding en route;

(3) Is discharging at an instantaneous rate of oil content not exceeding 60 liters per nautical mile;

(4) Is an existing vessel and the total quantity of oil discharge into the sea does not exceed 1/15,000 of the total quantity of the cargo and the discharge formed a part, or is a new vessel and the total quantity of oil discharged into the sea does not exceed 1/30,000 of the total quantity of the cargo that the discharge formed a part; and

(5) Has in operation an oil discharge monitoring and control system approved by the Coast Guard (specification regulation to be proposed)" (Section 157.37(a)).

as 294 gallons of oil per voyage of a 30,000 deadweight ton tanker.47/

In point of fact, the proposed limitations are substantially lower in key respects than originally proposed by the United States to IMCO and as supported by the United States at the IMCO Conference in October 1973.48/ For example, it is obvious that to prohibit discharges within a hundred miles from the coast -- the original U.S. proposal to IMCO -- is preferable to the 50 mile limitation now proposed, for it further removes discharges from biologically sensitive inshore areas and allows more time for the "weathering" of oil before it reaches such areas. No justification whatsoever is given for the Coast Guard's change of mind. As far as we are aware, from an environmental standpoint, none can be given.

We firmly believe that before any proposed discharge standards could be supported, they must be justified environmentally, i.e., the damage to the marine environment produced at a 60 litre per mile discharge rate must be set forth and assessed. And discharge criteria should only be established if the following two conditions are met: (1) conclusive evidence shows that it is not technologically

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47/ As the Draft Impact Statement admits (at pages 39-41), the discharge criteria will allow discharges of oil from the U.S. fleet ranging from a high of approximately 12,000 tons per year to a low of approximately 4,000 tons per year. While this would represent an improvement over the current 53,000 ton annual rate (Draft Impact Statement at page 33), it scarcely amounts to the "complete elimination" of operational pollution.

48/ See Comments and Proposals Submitted to IMCO by the Government of the United States of America on the Fifth Draft of the 1973 IMCO Convention, International Conference on Marine Pollution, MP/Conf/8/9 (July 19, 1973). In this, as in other areas, the statement in the Draft Impact Statement (at page 4) that the proposed rules are "consistent with the U.S. proposal at the 1973 Conference" is thus somewhat misleading.

feasible to reduce discharges below those levels, and (2) conclusive evidence demonstrates that discharges at such levels are not harmful to the marine environment. As was clear from the debates at the IMCO Conference in October 1973, the discharge criteria in Section 157.37 are not supported by any meaningful evidence indicating that they meet these conditions.

Even assuming, however, that the proposed limitations were environmentally adequate, it is apparent that, because of the difficulties alluded to above of following the load-on-top procedure in coastwise trade, even these limitations will not be able to be met on many voyages and, thus, shoreside reception facilities will be required to handle dirty ballast and tank washings.49/ Although this is recognized in the Draft Impact Statement (i.e., at pages 38-39, and 42), its implications, which are serious, are never explored. The creation of shoreside reception facilities may merely transfer marine pollution problems to the shore and, in fact, as the Draft Impact Statement indicates at page 53, concentrations of oil pollution in a specific shoreside location may be more harmful environmentally than regulated discharges at sea. Further, their creation may pose substantial land use problems and have serious secondary impacts in the areas in which they are located. Finally, at present the state of the art may not be sufficiently developed to indicated the type of shoreside facility best

49/ While facilities may be required for tank washings, even in segregated ballast tankers, the difference in volume of dirty water to be handled if only tank washings are involved is substantial and thus the reception facility problem is greatly reduced if not entirely eliminated.

suited environmentally for each port. 50/

The failure to require segregated ballast on the widest practicable span of coastwise tankers necessarily will maximize the reception facility problem. Clearly, detailed analysis is required of the overall costs (including environmental and social costs) of this result, together with an assessment as to how effectively effluent standards for such facilities can be policed and enforced. Certainly, projections should be made to show just how much oil will have to be treated at major U.S. ports over the short and long terms and what the costs of such treatment will be. To take just one example, if indeed two million barrels a day flow through Valdez from the Trans-Alaska Pipeline and if tankers without segregated ballast serve this port, even if the treatment facility can provide for separation down to 10 ppm, hundreds of barrels of oil per day will flow out of the treatment facility. Similar consequences may be felt, although to a lesser degree, at other loading ports in the lower 48. How will all the costs associated with the construction and operation of these facilities

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50/ For a general discussion of the problems associated with development of reception facilities -- an industry which is still in its infancy -- see United States Department of Commerce, Final Environmental Impact Statement on Maritime Administration Proposed Shore Facility for Treatment and Disposal of Ship-Generated Oily Wastes (filed November 27, 1973; N.T.I.S. Report No. EIS 731850F).

compare, in 1980, say, with the incremental costs of providing segregated ballast on the vessels which serve them? Surely there is a possibility that it may cost more to treat the problem in the end than not to create it in the first instance. Certainly the various trade-offs of port reception facilities versus segregated ballast systems should be carefully examined before far reaching proposals such as those now under consideration are made. The Coast Guard, however, has essentially ignored the dilemma.

B. Reduction of Accidental Outflows

If segregated ballast appears to be the best way to solve the problem of eliminating (or at least substantially reducing) the operational outflow problem, it also appears that double bottoms provide the most effective way to "reduce cargo loss following ... groundings".51/ From 1969 through 1972, groundings accounted for almost 25% of the oil outflow from tanker accidents worldwide.52/ As noted above, the United States has consistently advocated the use of double bottoms,

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51/ Tank size limitations may also reduce outflows following accidents. However, we would question the adequacy of the tank size limitations (Section 157.19) which the Coast Guard proposes. These limitations are essentially those adopted by 1971 amendments to the 1954 International Convention for the Prevention of Pollution of the Sea by Oil and restated in Annex 1, Regulation 24, of the Convention. Moreover, they do not even represent an "improvement" over existing tanker standards, for they provide virtually no change in current industry practice. They are at the top of the scale of what is now incorporated on supertankers, allowing from 141,519 barrels to be contained in any single wing tank and 314,487 barrels to be contained in any center tank. It is obvious that a complete loss of cargo from a single tank meeting these size limitations could be environmentally disastrous. MarAd estimated last year that reduction in tank size by a factor of two could reduce annual outflows by as much as 13% on a 380,000 deadweight ton tanker. MarAd EIS at VI-57. It is therefore apparent that some consideration must be given by the Coast Guard to further tank size reductions.

52/ Draft Impact Statement at 32.

and this support, based on solid data,53/ was unwavering through the IMCO Conference held in October 1973 in London. Thus, in his opening statement of October 8, 1973, Russell Train, Chairman of the United States delegation, stated: "We believe that the Conference must require segregated ballast through double bottoms on the maximum practicable span of tankers." During the course of the Conference the United States presented further technical information with regard to the effectiveness of double bottoms in reducing accidental pollution. In a Note entitled Minimization of Oil Pollution From Oil Tankers Due to Bottom Damage (M.P. /Conf/C.2/WP 33), it was estimated that double bottoms (with a height of B/15) would have been effective in preventing outflow in 90% of the strandings which occurred within the navigable waters of the United States between

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53/ See generally Kimon, Kiss, Porricelli, Segregated Ballast VLCCs, paper presented to the Chesapeake Section of the Society of Naval Architects and Marine Engineers (January 11, 1973); United States Coast Guard, Reports on Parts 1 and 2 of Study I, Segregated Ballast Tankers (June 1972 and February 1973). The Coast Guard's recently assembled argument (Draft Impact Statement at page 35) that double bottoms fitted on U.S. tank ships in domestic trade "would prevent only a fraction of the total outflow" from casualties seems a weak reed to rely upon in rejecting this feature, especially since, as the Coast Guard candidly admits, using a one year data base -- as it has done -- in reaching this conclusion "may be misleading".

1969 and 1973, and "approximately 11,000 of the 12,499 tons of oil pollution or 87% of the pollution would have, indeed, been prevented." The same Note stressed that double bottoms are especially needed on "smaller tankers entering ecologically sensitive waters where traffic density, physical configurations, or weather factors combine to create a substantial risk of accident." This Note, significantly, was introduced after the United States proposal for making double bottoms part of the segregated ballast requirement had been voted down by the Conference and indicates the independent importance which the U.S. experts accorded to this feature.54/

There is no question that the commitment of the Coast Guard to the double bottom concept has been and continues to be justified. The arguments put forward against this feature from a technical standpoint -- inherent decrease in stability, loss of buoyancy in a grounded double bottom, danger of explosion and effectiveness only in minor

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54/ It might be pointed out that the Congressional judgment that double bottoms represent an environmentally sound approach to the accidental pollution problem, all but explicitly stated in the Act, has also been reaffirmed since the 1973 IMCO Conference. Thus the Senate version of H.R. 8193, the Energy Transportation Security Act of 1974, specifically mandates this feature on U.S. flag oil tankers in excess of 20,000 deadweight tons carrying oil to this country under a cargo preference scheme. See Report of the Senate Comm. on Commerce on H.R. 8193, 93d Cong., 2d Sess. 19-25 (Rep. No. 93-1031) (July 25, 1974).

accidents[55] -- have always been dealt with by the Coast Guard in the past and have been found to be insignificant.[56] No new evidence was provided at the IMCO Conference, Mr. Murphy's protestations to the contrary, to undercut the U.S. conclusions. In point of fact, the purported deficiencies of the double bottom concept are more apparent than real. Vessels of double bottom design meet all the international stability requirements. Some loss of buoyancy in a grounding situation is of little consequence because most groundings involve low velocity impacts, with the vessel not running hard aground. The purported explosion hazard in a double bottom is no greater than in any other ballast space and can be solved by inerting. And, finally, as to its effectiveness only in "minor" groundings, the simple fact is just that this is what most groundings are.

55/ See, e.g., Statement of Robert J. Blackwell, Assistant Secretary of Commerce for Maritime Affairs, House Oversight Hearings at 170-195; Statement of Hon. John M. Murphy before the Department of Transportation with respect to the Proposed rules (July 31, 1974). Ironically, Assistant Secretary Blackwell, in announcing his agency's award of subsidy contracts for four 89,700 deadweight ton tankers on June 12, 1974, and in pointing to the advanced pollution abatement features of such vessels, has also stated, "These ships are equipped with double bottoms that will help prevent loss of cargo into the sea should one of the vessels run aground", U.S. Department of Commerce News, MA NR 74-14 (June 14, 1974), and MarAd has in fact subsidized the construction of 10 double bottomed tankers over the past year.

56/ See, e.g., Segregated Ballast Tankers Employing Double Bottoms, supporting document to D.E. VIII/12 and M.P. XIV/3(c), presented to IMCO (November 1972) at 17; IMCO EIS at 47. The Draft Impact Statement does not take a different view, and in fact accepts the conclusion (at pages 54-55) that double bottoms would prevent outflows in 90% of all grounding incidents, or approximately 45,000 tons per year worldwide.

Of thirty groundings which occurred between 1969 and 1973, the extent of vertical damage was less than .067B in twenty-seven cases.57/ The key point is that a double bottom provides an immediate benefit in the grounding situation: there is no outflow of oil.

That double bottoms are a structurally sound approach to the accidental oil pollution problem would appear to be borne out by the fact that numerous liquid cargo carriers do incorporate them. Indeed, they are nationally and internationally required for vessels carrying other hazardous polluting substances.58/ Moreover, in this country more than twenty double bottomed tankers are now on order or under construction.59/ The purchasers of these tankers and the yards which are building them have publicly made the

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57/ Card, Effectiveness of Double Bottoms in Preventing Oil Outflow from Tanker Bottom Damage Incidents (1973).

58/ See IMCO Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk, Chapter II, IMCO Assembly Resolution A.212(VII) (October 12, 1971); 1973 IMCO Convention, Annex II, Regulation 13; proposed IMCO Code for the Construction and Equipment of Ships Carrying Liquified Gases in Bulk, D.E./92 (September 20, 1973); 46 C.F.R., Subchapter D; see also United States Department of Commerce, Final Environmental Impact Statement on Maritime Administration Bulk Chemical Carrier Construction Program IV-16-IV-20 (N.T.I.S. Order No. MA-EIS-7302-7403-F; August 9, 1974); Page, "The Prevention of Pollution from Chemical Tankers", Proceedings of the Royal Institution of Naval Architects, February 27, 28, 1973.

59/ See House Oversight Hearings at 247-252 and attachment A hereto for an update of such information.

case for the soundness of this design from an operational, as well as pollution abatement, perspective.60/

Finally, with regard to the cost of this feature, not only did Congress determine that economic considerations should not preclude adoption of segregated ballast and double bottom requirements61/, but any increase is likely to be relatively small, e.g., perhaps as low as 2 percent in some cases62/, and may be substantially offset in any event by reductions in operating costs.63/ As even Congressman Murphy conceded in his July 31 testimony on the proposed rules, "Price is no longer the major objection of shipbuilders to this concept."64/ And, the United States tankers

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60/ See Proceedings of the Panel Discussion on Environmental Protection and Tanker Design for the Intersociety Conference on Transportation, Denver, Colorado, September 25, 1973.

61/ Senate Report at 2897-2900.

62/ MarAd EIS at VI52-VI53.

63/ See generally Proceedings of the Panel Discussion on Environmental Protection and Tanker Design for the Intersociety Conference on Transportation, Denver, Colorado, September 25, 1973; IMCO EIS at 39-52.

64/ The American Institute of Merchant Shipping, for example, has concluded, "[C]apital increments of this order would not represent an unreasonable burden for industry or consumers -- if the double bottom could assuredly do what its advocates feel it could." American Institute of Merchant Shipping, "Tanker Double Bottoms: Yes or No?" (1974) (emphasis original). As demonstrated above, we believe that this caveat has been met.

incorporating this feature have done so for a relatively low incremental cost increase over the base ship price.65/ It must therefore necessarily be concluded that such features can be added to tank vessels with little or no economic penalty.

(3) Vessel Traffic Control, Equipment and Manning

The various "marine traffic requirements" set out in the Coast Guard's proposals (CGD 74-77), while desirable, can in no way be considered to make up for the deficiencies in the vessel standards outlined above. In the first place it is questionable just how much improvement they will provide over existing practice. Indeed, the Coast Guard's conclusion (Draft Impact Statement at page 57) that the operational requirements applied to all vessels will "yield greater dividends with respect to reduction of accidental pollution" than requiring new U.S. coastwise tankers to have double bottoms is not supported by any evidence presented in the Draft Impact Statement. In the second place, it is clear that Congress mandated substantial changes in vessel design and construction, regardless of what traffic control, equipment or manning requirements could be developed.

65/ See House Oversight Hearings at 247 to 252 and Attachment A hereto for an update of such information.

The proposals in CGD 74-77, as regards equipment and manning, do little more than codify existing industry practice. Few tanker operators set out from port, especially on international voyages, without "parallel rules" or "dividers" or "corrected charts". For that matter, even such relatively sophisticated devices as anti-collision radar are now required by MarAd on all tank ships receiving construction-differential subsidies66/, and there appears to be no reason why all vessels above 5,000 gross tons should not be required to have such a device. All this is not to suggest that such codification is not desirable, but rather to say that reliance on such proposals to improve radically the accidental pollution problem may be somewhat misplaced.

With respect to the traffic control requirements, these are essentially of little help to the Captain of the Port who will implement them.67/ Absolutely no guidance is given

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66/ See Final Opinion and Order of the Maritime Subsidy Board, MarAd Tanker Construction Program, Docket No. A-75 (August 30, 1973); Recommended Revisions to Standard Specifications for Merchant Ship Construction, 38 Fed. Reg. 27537 (October 4, 1973), 39 Fed. Reg. 27483 (July 29, 1974). It should also be pointed out that, more than two years ago, the National Transportation Safety Board recommended that vessels be equipped with collision avoidance systems. See Report No. NTSB-NSS-72-1 (February 2, 1972); MarAd EIS at VI-70-VI-71.

67/ The requirements are ambiguous as to whether a Captain of a Port has authority to require vessels entering waters under his jurisdiction to meet special design and construction standards rather than merely to require vessels not meeting such special standards to comply with particular traffic restrictions. Even if such power existed, of course, it would be unlikely to be exercised given the Coast Guard's predilection for national and international uniformity.

to the Port Captain as to what appropriate vessel traffic controls should be required in light of various combinations of the fifteen enumerated variables. At the least, the Coast Guard must develop some conceptual or actual models in this area which can be utilized by Port Captains in devising appropriate schemes. Finally, the traffic requirements apply in port only and contain no provision for vessel traffic separation routes between ports, although these plainly offer the possibility of reducing the risk of accident. Even to the extent that mandatory vessel traffic control schemes are established, in Puget Sound and Prince William Sound, for example, for the Alaskan oil trade, the environmentally perilous routes through the Straits of Juan de Fuca would remain unregulated under the proposed rules.68/

68/ While Rear Admiral Benkert, Chief of the Office of Merchant Marine Safety of the Coast Guard, stated in his opening remarks at the public hearings on the proposed rules held in Washington on July 30-31, 1974, that traffic separation schemes are "planned" for the Straits of Juan de Fuca and that the Coast Guard is "studying implementation of sea lanes for vessels traversing the Alaska-West Coast run", whether these plans will in fact be implemented is not clear. Because international waters are involved, if rules for passage through international straits are evolved at the Law of the Sea Conference, they will undoubtedly have a heavy bearing on what the United States, or even the United States jointly with Canada, can do in this area.

As regards the relationship between vessel traffic control and vessel design requirements, we wish to restate the emphatic points made in the Senate Report on their interdependency:

> "Although concurring in the need for vessel traffic services, systems and controls...., the committee believed that a comprehensive approach to the prevention of pollution from marine operations and casualties required, in addition, improvement of the vessels themselves: their design, construction, maintenance and operation. The testimony and data received at the committee's hearings . . . made this conclusion inescapable. It is clear that a systems approach to prevention of damage to the marine environment requires not only better control of vessel traffic but an improvement in the vessels themselves.
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> Presumably vessel traffic controls will have their maximum impact in congested harbors and harbor entrances. . . . However, polluting incidents are not limited to these areas and, in fact, some incidents such as structural failures and groundings occur as frequently, more frequently, or nearly as frequently, in other areas. In such other areas, an approach geared to improvements in vessel design and construction may be more effective than an approach geared to vessel traffic control."69/

The very purpose of S. 2074, which became Title II of the Act, was to supplement the traffic control requirements originally embodied in H.R. 8140 and ultimately written into Title I of the Act.

The Coast Guard's proposals, insofar as they involve electronic safety and manning requirements, as well as traffic controls, do constitute a worthwhile first step towards a "systems approach",70/ but it is clear that

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69/ Senate Report at 2893, 2896-2897.

70/ It must be remembered, of course, that none of the items set out in CGD 74-77 would help prevent operational pollution and thus can in no way substitute for needed segregated ballast and tank cleaning equipment requirements.

environmentally sound structural approaches, which will help eliminate or negate the factor of human error in pollution incidents, must be required as well if they are cost and pollution control effective. Because, for example, navigational errors will be made and ships will go aground even if "parallel rules", "dividers" and large scale charts are required to be on board all vessels of more than 150 gross tons (Proposal 2(a)(4) and (5)), it would seem that maneuverability devices, i.e., thrusters, controllable pitch propellers, twin screws/twin rudders, could well provide the necessary means for quickly correcting those errors and avoiding groundings. Similarly, because accidents will occur, structural features such as double bottoms, which would prevent oil outflow in the first instance, would appear called for. The point here is a simple one: all the aspects of a "systems approach" are interrelated, and it does not suffice to substitute manning or operational requirements, however sound, aimed at reducing the risk of accident either for features such as thrusters, aimed at the same result by a different means, or for other features, such as double bottoms, aimed at mitigating pollution damage should an accident occur.

(d) The Desirability and Feasibility of Imposing High Standards on Coastwise Trade

Although the IMCO Conference held in October 1973 did not fully adopt the United States' proposals, nonetheless, as Russell Train stated in testimony before the Senate Commerce Committee on November 14, 1973, "the treaty does not contain any provision, positive or negative, regarding

the rights of State to set more stringent standards *within* their jurisdiction", and there is "nothing whatsoever" in the treaty which would prevent the United States from requiring double bottoms or any other design feature on tankers trading in U.S. waters. Certainly the United States can impose, consistent with any treaty obligations it assumes, whatever design and construction requirements it deems appropriate on its own flag ships engaging in coastwise trade and this would in no way be inconsistent with a uniform scheme of international regulation or, as noted above, adversely affect the competitiveness of United States shipping. In this regard, we would note that the official U.S. position at the Law of the Sea Conference is that port states must be given the right to impose and enforce vessel pollution standards, different from international standards, on any ships entering their ports.71/ The Coast Guard's fear that imposition of more stringent standards would be "construed by foreign observes as a 'portent' of the future" and evidence of intent of the U.S. government "not to abide by" the provisions of the 1973 IMCO Convention (Draft Impact Statement at 51), is thus not only speculative but cannot under any circumstances

71/ See U.S.A. Draft Articles on the Protection of the Marine Environment and the Prevention of Marine Pollution, U.N. Doc. A/AC 138/SCIII/C.40 (July 18, 1973), Article IV.

constitute a basis for not requiring U.S. flag vessels trading in our coastwise waters to meet the highest standards when such a requirement offers absolute environmental benefits. 72/

Ultimately, the failure of the Coast Guard to propose any standards for our coastwise trade other than those of the 1973 IMCO Convention raises the fundamental question as to whether the United States should go its own way on issues of vessel pollution standards and simply forget about achieving solutions in the international forum. There is no question that the 1973 IMCO Convention, for all that it does to improve the condition of the marine environment, represents a "low common denominator" as to both construction and discharge standards. Indeed, the Senate Commerce Committee is already on record to this effect. 73/ And there is

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72/ The other arguments put forward by the Coast Guard in the Draft Impact Statement are equally without merit. That "no immediate savings" could be expected from higher design standards (55), a conclusion which follows from its unfortunate provision of absolute grandfather rights, would argue against any design standards whatsoever and, if accepted, literally cut the heart out of the Act. That standards only applying to U.S. vessels in coastwise trade would be less beneficial than standards applying to all vessels (56) is true but scarcely undermines the absolute benefits which application of such standards to coastwise trade would have. And, that the "cost of compliance [would be] out of proportion to the beneficial effect" (56) flies in face the Coast Guard's conclusions in September that benefits outweighed costs. IMCO EIS at 47. Indeed, when one contemplates the $.15 to $.20 increases which have occurred in the price of gasoline per gallon at the pump over the last year, the incremental increases in such price measured by tenths of a cent or less which might be associated with passing on the cost of added pollution abatement features, see Senate Report at 2897, are insignificant and would scarcely seen to outweigh the "public benefit" of increased protection of the marine environment.

73/ See Report of the Senate Comm. on Commerce on H.R. 8193, 93d Cong., 2d Sess., 19-25 (Rep. No. 93-1031) (July 25, 1974).

no doubt that the nited States, consistent th the letter of that Convention, could impose higher standards on oil carrying vessels entering its waters or ports or engaged in coastwise trade. Yet if the effect of our participation in that Convention, regardless of its terms, is to foreclose that possibility, in spite of potential environmental benefits, through some alleged vague moral commitment not to improve upon internationally arrived at -- albeit inadequate -- standards, its value must be seriously questioned. At the very least, we must ask ourselves whether our coastlines and waters are better protected by minimum international standards or by more sensible national standards. And if the latter provides better protection, then the wisdom of a commitment to the 1973 IMCO Convention and to international solutions generally is cast in doubt.

(e) Conclusion

In conclusion, we reemphasize the importance which the environmental groups attach to and the urgent need for prompt adoption of the most stringent environmental standards for tank vessels engaged in coastwise trade. In passing the Act, Congress made it clear that the objective of protection of the marine environment should not be sacrificed on the altar of the principle of international regulation.74/ In amending the Act in November 1973 to provide for application to coastwise trade by June 30, 1974 (see Pub. L. No. 93-153, enacted November 16, 1973), Congress appears to have intended to insure that tankers carrying oil in such trade, and, in particular, on the environmentally sensitive Valdez-West Coast run, would meet the highest environmental standards at the earliest possible date. The Coast Guard, over the past two years, has built up an unassailable record supporting tough,

74/ Senate Report at 2903, 2908.

new design and construction standards, especially the segregated ballast/double bottom system. The proposed rules issued by the Coast Guard on June 28, while representing a step forward, simply fail to live up to the Congressional mandate and to the Coast Guard's own prior and well-founded commitment to stringent anti-pollution control. Furthermore, the Draft Environmental Impact Statement, in its current form, fails to provide an adequate basis under NEPA for taking the proposed action. We would urge, therefore, that the Draft Impact Statement be thoroughly revised in form and substance. If it is, and if the information set out above is properly taken into account, we firmly believe that it must inevitably lead to the conclusion that the regulations must be strengthened to meet the mandate of Congress, and that, in particular, such regulations must require incorporation of segregated ballast/double bottom systems and improved maneuverability features on the maximum practicable span of oil carrying vessels engaged in coastwise trade and exclude non-complying vessels from such trade after an appropriate period of time.

Very truly yours,

Eldon V.C. Greenberg
Counsel to Sierra Club,
Environmental Defense Fund,
Natural Resources Defense Council,
National Parks and Conservation
Association, Friends of the Earth,
The Wilderness Society, the National
Wildlife Federation, and the National
Audubon Society

Attachment A
to Center for Law and Social Policy letter dated August 19, 1974

Double-Bottomed Tankers Planned
or Under Construction in
U.S. Shipyards

The following information is supplied to update through July 25, 1974, the list of double-bottomed oil tankers planned or under construction in U.S. shipyards, contained in the House Oversight Hearings at pages 247-252:

(1) On December 18, 1973, Chestnut Shipping Co. agreed to purchase, with the aid of a subsidy of 33.38% from MarAd, two 89,700 deadweight ton tankers, with double bottoms, from National Steel and Shipbuilding Co. for a price of $32.5 million per vessel.

(2) On June 12, 1974, Hawaiian International Shipping Corp. agreed to purchase, with the aid of a subsidy of 33.66% from MarAd, three 89,700 deadweight ton tankers, with double bottoms, from Todd Shipyards Corporation, for a price of $38.8 million per vessel.

(3) As of July 25, 1974, applications for fourteen oil tankers, combination ore/bulk/oil carriers or integrated tug/barges in the 80-100,000 deadweight ton class, with double bottoms, had been filed and were pending with MarAd since June 30, 1973, as follows:

(a) Apollo Marine Shipping Company filed an application on September 17, 1973, for one 89,700 deadweight ton tanker to be built for an unspecified cost.

(b) Ecological Tanker Corp. filed an application on October 10, 1973, for three 90,000 deadweight ton tankers to be built for a cost of approximately $36 million per vessel.

(c) Farrell Tankers Incorporated filed an application on November 23, 1973, for four 89,000 deadweight ton tankers to be built for a cost of approximately $34 million per vessel.

(d) Fuel Transport, Inc. filed an application on August 27, 1973, for two 89,700 deadweight ton tankers to be built for a cost of approximately $30 million per vessel.

(e) Western Bulkship Associates filed an application on December 4, 1973 for four 80,000 deadweight ton OBO's to be built for a cost of approximately $34 million per vessel.

Response to Comments by Center for Law and Social Policy in a letter dated 19 August 1974 submitted on behalf of

The Sierra Club

Environmental Defense Fund

Natural Resources Defense Council

National Parks and Conservation Association

Friends of the Earth

National Wildlife Federation

The Wilderness Society

National Audubon Society

Comment

While the proposed rules do contain much that is valuable for protection of our marine and coastal environment and would undoubtedly bring about environmental improvement, they simply do not go far enough toward achieving the goal to which the United States (and other nations) are committed: The complete elimination of intentional pollution by oil and other harmful substances and the minimization of accidental discharges of such substances - by 1975 if possible, but certainly by the end of the decade.

(CLSP, p. 125)

Response

The question is one of "how far, how fast." The Coast Guard views these regulations as one step in a continuing process of controlling man's oil inputs to the world's oceans. Certainly much more remains to be done. Because of the need for international agreement on methods of limiting oil inputs to the world's oceans, the Coast Guard has taken the position that the U. S. can best contribute to the goal of eliminating intentional pollution and minimizing accidental discharges by a series of orderly carefully-thought-out steps. These regulations represent one step toward that goal. Extension of similar requirements during 1976 to U. S. tank vessels in foreign trade and foreign tank vessels entering U. S. waters will be another step.

Comment

The Coast Guard has misinterpreted the provisions of R.S. 4417a:

(1) A statement made in the preamble to the proposed rules appears to contend that the statute requires identical standards to be established for both coastwise and foreign trade. (See page 129 of this EIS for text of the Statement.) Nothing in the statute or its legislative history imposes such a requirement.

(2) Differing considerations apply to vessels in the coastwise trade than to those in foreign trade.

(a) Coastwise trade is reserved to U. S. vessels alone. Accordingly there would be no competitive disadvantage to U. S. vis a' vis foreign vessels resulting from the imposition of more stringent standards to vessels in this trade than to vessels in the foreign trade.

(b) There is environmental justification to support the application of higher standards to coastal traffic. Coastal tankers will tend to spend more time in ecologically sensitive waters. Therefore, the risk of environmental damage posed by these vessels due to operational discharges (primarily from ballasting operations) and accidental discharges (due to especially high risk of groundings and collisions created by entry into narrow, shallow, and crowded harbors) is higher than the risks posed by other vessels.

(CLSP, pp. 128-133)

Response

The Coast Guard has not misinterpreted the provisions of R.S. 4417a. Unfortunately the statement referred to has been misunderstood and the term "coastal traffic" has been confused with the term "coastwise trade."

(1) The statement in the Preamble to the June 28, 1974, proposed rules referred to above merely pointed out the following:

(a) R.S. 4417a(7)(1) requires equality of treatment between U. S. and foreign vessels engaged in foreign trade.

(b) A reading of paragraphs (C) and (D) of subsection (7) of R.S. 4417a leads to the conclusion that no distinction of treatment between U. S. (domestic or foreign trade) and foreign vessels may be inferred from any treaty, convention, or international agreement.

(c) The distinction between U. S. coastwise and foreign trade vessels in R. S. 4417a appeared for the first time in its 1973 amendment (section 401 of Public Law 93-153, Act of November 16, 1973). This amendment merely advanced the date on which the regulations would become effective for vessels in the coastal trade.

(d) The regulations will accordingly apply on an interim basis solely to vessels in the coastwise trade until the same or similar regulations are made effective to both U. S. and foreign vessels in the foreign trade.

The statement in the Preamble did not contend nor was it intended to imply that R. S. 4417a required the Coast Guard to impose identical standards on foreign and coastwise vessels. It does, however, point up the fact that the statute does not require that differing standards be applied to vessels in the two trades. It is the Coast Guard's position that there must be a reasonable basis of a safety or marine environmental protection nature to support the imposition of differing standards upon these two classes of vessels.

(2) The above comment suggests two bases to support regulatory classification of vessels into foreign and coastwise trades: (a) absence of competitive disadvantage if different standards are applied, and (b) the greater risk to ecologically sensitive areas posed by "coastal traffic." These suggestions are addressed in turn:

(a) No detriment to competition. Even if one were to accept the proposition that the imposition of more stringent standards on vessels in coastwise trade would not result in a competitive disadvantage to those vessels (a proposition which is subject to serious question, in view of the practice of some operators to use their vessels in both domestic and foreign trades), it would provide no justification for the establishment of separate classes of vessels for regulatory purposes. The purpose for which these regulations are to be promulgated under R. S. 4417a is the enhancement of safety and marine environmental protection. A classification making a distinction in regulatory standards can only be supported if there is a basis upon which a reasonable distinction may be made between vessels in foreign trade and those in coastwise trade on safety or environmental grounds. The existence or absence of competitive disadvantage does not provide sufficient grounds to support the establishment of separate regulatory classes for vessels in foreign trade and those in the coastwise trade.

(b) Risk to coastal ecology. The suggestion that a classification system may be established to distinguish between coastwise and foreign trade vessels, based upon the risk which "coastal traffic" poses to the particularly sensitive coastal environment, is premised upon an erroneous implication, i.e., that "coastal traffic" is synonymous with "coastwise trade." These terms are not synonymous. The tanker traffic along the coast and in the harbors and waterways is composed both of coastwise and foreign trade vessels. The threat to ecologically sensitive areas from a vessel navigating along the coast does not depend upon the source or destination of the oil, but rather from circumstances prevailing on the vessel and in the coastal and internal waters. While it is true that greater portions of coastwise trade passages than foreign trade passages occur within the coastal areas, this does not change the fact that the environmental threat is posed by the presence of vessels in these areas and not the trades in which they are engaged.

It is true that distinctions have been made in the past between vessels operating solely in the internal and near-shore waters and vessels operating on long offshore passages. In those cases where this distinction was made, the length of passage or distance from shore was directly related to safety considerations applicable to the vessels. Generally speaking, operation in sheltered waters or on shorter passages permits a relaxation of safety oriented requirements, since the characteristics of the operational situation external to the vessel itself make for a safer operation. In the present case, however, the characteristics of the situation external to the vessel create the same environmental threat to the vessel regardless of its trade.

AD-A036 719 COAST GUARD WASHINGTON D C OFFICE OF MERCHANT MARINE--ETC F/G 13/2
REGULATION FOR TANK VESSELS ENGAGED IN THE CARRIAGE OF OIL IN D--ETC(U)
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Comment

A major difficulty with the Coast Guard's approach is the creation of "grandfather" rights which will insure that the risks of pollution of our coastal waters remain high for years to come. Certain critical requirements (segregated ballast on vessels over 70,000 DWT, in particular) need only be met by "new vessels."

(CLSP, p. 134)

The "grandfather rights" approach proposed by the Coast Guard could, as a practical matter, render its requirements for new vessels ineffectual until sometime in the 1980s.

(CLSP, p. 136)

The Coast Guard's proposal would leave a greatly expanded fleet of oil-carrying vessels (now under construction or contracted for) with useful lives of 20 years, free to engage in U.S. coastwise trade without meeting stringent pollution control requirements.

(CLSP, p. 137)

The Coast Guard should establish an absolute cut-off date, perhaps after some progressive phase-out period, within the near future, after which no oil-carrying vessel -- regardless of its contract, construction or delivery date -- would be permitted to engage in coastwise trade unless it met the requirements for new tank vessels.

(CLSP, p. 138)

Response

There are really two separate issues here. One is the general practice of including in laws or regulations so called "grandfather clauses" which exempt existing units from new requirements. The other is the question of whether segregated ballast should be required on existing U.S. tankers over 70,000 DWT.

Many new laws and regulations include so called "grandfather clauses." This term refers to the practice of making some new requirement applicable only to new units built after a specific date. Existing units (whether they be cars or ships or electric razors) may continue to be used until the end of their normal lives. This sort of provision is often included in cases where alteration of existing units to meet new regulations would be difficult or expensive, and someone has decided that the benefits to be gained by modifying or retiring existing units are not considered worth the cost involved. Automobile exhaust emission standards are a good example of such a situation. New cars are required to meet higher standards, while existing cars are allowed to serve out their useful lives as long as they continue to meet the standards in effect at the time of their manufacture.

The decision whether existing units should be allowed to escape a new requirement through a grandfather clause o. give a choice of retrofit or early phaseout is essentially a balancing of the needs and rights of an individual against those of society at large. A number of factors enter into such a decision:

How urgent is the need for the improvement the new standard will bring?

How costly will it be to retrofit existing units or phase them out? (in terms of money, lost productivity, disruption of service, etc.)

How practical is it to retrofit existing units? (Are necessary facilities and materials available?)

As is the usual case, cost is being balanced against need, and it is usually difficult to quantify either; so a great deal of judgment enters into the decision.

This, then, is the situation faced by Congress, a regulatory agency, or anyone else when considering a "grandfather clause -- the balancing of conflicting rights and interests.

A specific case of this is the second issue raised by these comments: "Should segregated ballast be required on existing ships?[20]

A discussion of this question has been added to the statement and now appears on page 62.

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[20] Note that existing tank vessels must meet the discharge criteria, slop tank requirements, and machinery space bilge requirements; so segregated ballast is the only major requirement that existing ships escape. See Table 5 on page 44 for details of applicability of the various requirements.

Comment

Coast Guard studies, prepared in developing the United States position for presentation to the 1973 IMCO Conference, concluded that the environmental benefits of the segregated ballast/double bottom system were: (1) Operational pollution reduced 95%, (2) Accidental pollution reduced 35%, and (3) Total pollution reduced 67%. The Coast Guard concluded (before the Conference) that "in terms of segregated ballast designs studied, the double bottom design is clearly the most effective when both operational and accidental pollution are considered," and that "segregated ballast was economically viable aboard tankers of 20,000 DWT or greater." In spite of these conclusions and recommendations, the proposed rules only call for segregated ballast on tankers larger than 70,000 DWT, and make no provision for double bottoms.

(CLSP 143-145)

Response

The Coast Guard's position prior to the 1973 Marine Pollution Conference was a function of what we knew then. We know now that some of the conclusions, particularly those based on accident statistics, were not as well supported as they should have been. (See pages 72-76 for further discussion on this point.) What the rules require is also influenced by the results of the Conference, and this is discussed on pages 4-8.

Comment

The inherent limitations of LOT procedures as an alternative to segregated ballast (LOT is ineffective on short ballast voyages or vessels in oil product trade) make it least useful in coastwise trade, since coastal trips tend to be short (3-5 days) and many coastal tankers carry refined products. This ineffectiveness is magnified in the Valdez/ West Coast trade where adverse weather conditions may impede the separation process. Thus application of the segregated ballast requirement to smaller tankers engaged in that trade would appear to be environmentally mandated.

(CLSP, p. 145-147)

Response

As discussed on page 61, vessels loading at Valdez will by a stipulation in the permit agreement between the Department of the Interior and Aleyska Pipeline Corporation be required to discharge all oily residues ashore to a shore reception and treatment facility. While Load-on-Top (or, more properly, Retention-on Board) techniques are generally considered more difficult to use effectively on short voyages or on product carriers, the Coast Guard believes they will provide an acceptable method for controlling oil inputs from domestic trade tankers carrying refined products, as well as to the other vessels to which they are applied.

Comment

The impact of improvements in Load-on-Top procedure (the requirements that an oil discharge monitoring and control system approved by the Coast Guard be installed on coastwise tankers) is far from clear. The draft EIS nowhere discusses the effectiveness of such systems, their cost, the current state of the art, or, indeed the improvement they represent over existing practice. The conclusion (on page 37 of the draft EIS) that "this equipment will be an effective method of reducing significantly the oil discharge from this source," is thus factually unsupported, and it is particularly inappropriate where the Coast Guard has not yet even proposed standards for such equipment and where there is no indication when such proposals will be made, yet alone become effective.

(CLSP, p. 146)

Response

Tankers will have to use Load-on-Top(or, more properly, Retention-on-Board) techniques in order to stay within the discharge criteria discussed on page 14 The impact of these criteria on oil inputs to the marine environment are discussed on pages 45-46.

The discussion of oil discharge monitoring and control systems has been expanded and now appears on page 47.

Comment

We question whether the discharge criteria proposed in section 157.37 are sufficient to protect the marine environment. The environmental basis for these limitations is unclear -- they appear to do little more than codify existing outflow standards which are already met on the 75% of existing tonnage which utilize LOT. Before any proposed discharge standards can be supported, they must be justified environmentally, i.e., the damage to the marine environment produced at a 60 litre per mile discharge rate must be set forth and assessed. Discharge criteria should only be established if the following two conditions are met: (1) Conclusive evidence shows that it is not technologically feasible to reduce discharges below these levels, and (2) Conclusive evidence demonstrates that discharges at such levels are not harmful to the marine environment.

(CLSP, p. 149)

Response

The discharge criteria contained in the regulations are those contained in the 1973 Marine Pollution Convention. They represent results that can be achieved by diligent use of LOT techniques and oil discharge levels well below those at which environmental damage has been observed. At the 60 liters/mile level, whatever sheen is caused rapidly disappears a short distance behind the ship.

It would be a happy circumstance if it were possible to fully utilize the procedure outlined by the Center for Law and Social Policy in setting discharge standards. Unfortunately, as with many other environmental issues, "Conclusive evidence" just doesn't exist, and decisions must be made in the face of some uncertainty. Postponing any setting of standards until both these conditions can be met is not a prudent course of action. Prohibiting any further transportation of petroleum by water until they were met is not either. The Coast Guard has attempted to pursue some reasonable course of action between these two extremes.

Comment

The draft EIS recognizes the need for shore reception facilities for vessels which cannot use LOT to meet the discharge criteria, but the serious implications of this are never explored. The creation of shoreside reception facilities may merely transfer marine pollution problems to the shore, pose substantial land use problems, and have serious secondary impacts in the areas in which they are located. The present state of the art may not be sufficiently developed to indicate the type of shoreside facility best suited environmentally for each port.

(CLSP, p. 151)

Failure to require segregated ballast on the widest practicable span of coastwise tankers will maximize the reception facility problem.

(CLSP, p. 151)

Detailed analysis (of reception facility problem) should be made to examine various trade-offs of port reception facilities versus segregated ballast systems before far-reaching proposals such as those now under consideration are made. (It may cost more to treat the problem in the end than not to create it in the first instance.) Analysis should include:

Overall costs (including environmental and social costs) of reception facilities.

Assessment as to how effectively effluent standards for reception facilities can be policed and enforced.

Projections should be made of how much oil will have to be treated at major U.S. ports over the short and long terms and what the costs of such treatment will be.

How will the costs associated with these facilities compare in 1980 with costs of providing segregated ballast on the vessels which serve them?

(CLSP, p. 151)

Response

An expanded discussion of shore reception facility needs appears on page 47 but much of criticism above remains valid. Many questions concerning shore reception facilities do remain to be resolved. The Coast Guard is working now with other government agencies and appropriate facets of the marine industry to answer some of these questions. But delaying all regulations until the answers are available is not the answer, and the Coast Guard remains confident that these regulations are a sound step forward toward international control of oil inputs to the world's oceans.

Comment

The United States can impose, consistent with any treaty obligations it assumes, whatever design or construction requirements it deems approperiate on its own flag ships engaging in coastwise trade and this would in no way be inconsistent with a uniform scheme of international regulation or adversely affect the competitiveness of U.S. shipping. The Coast Guard's fear that more stringent standards for domestic shipping might jeopardize acceptance of the 1973 Marine Pollution Convention is unfounded and is no reason for not requiring U.S. vessels trading in our coastwise waters to meet the highest standards when such a standard offers absolute environmental benefits.

(CLSP, p. 165)

Response

There are two issues here: "Why has the Coast Guard taken the position that it is necessary to make regulations for seagoing U. S. tank vessels in domestic trade the same as the regulations for vessels engaged in foreign trade?" and "What effect could requiring more stringent construction standards for U. S. vessels trading in our coastwise waters have on acceptance of the 1973 Marine Pollution Convention?"

The first of these questions is discussed on pages 8 and 9 and, in response to an earlier Center for Law and Social Policy comment, on page 175. Since U. S. vessels in the domestic trade and those in foreign trade operate in the same coastal waters, the Coast Guard has found no basis upon which a reasonable distinction of a safety or marine environmental protection nature may be made between them. The Coast Guard has concluded, therefore, that regulations to be applied to U. S. tankers in foreign trade and foreign tankers entering U. S. waters must be the same as the regulations applied to U. S. tankers in domestic trade. Under these circumstances, more stringent construction standards applied to U. S. vessels in domestic trade (and, therefore, to vessels in foreign trade and foreign vessels) would, the Coast Guard believes, throw into question the ability of the United States to accept the 1973 Marine Pollution Convention. This most certainly would have an adverse effect on acceptance of the Convention by other nations.

Comment

The Coast Guard's failure to propose higher standards than those of the 1973 Convention raises the question: "Should the U.S. go its own way on issues of vessel pollution standards and simply forget about achieving solutions in the international forum?" At the very least, we must ask ourselves whether our coastlines and waters are better protected by minimum international standards or by more sensible national standards. If the latter provides better protection, then the wisdom of a commitment to the 1973 Marine Pollution Convention and to international solutions generally is cast in doubt. (CLSP, p. 166)

Response

The Coast Guard believes U. S. coasts and waters cannot be adequately protected from oil pollution from tank vessels unless international agreement on methods of limiting oil inputs can be reached. Consistent with the Congressional direction specified in section 102(2)(E) of the National Environmental Policy Act, this agency fully recognizes that the condition of this country's coasts and waters is directly linked to the condition of the rest of the world's oceans. The world's oceans will not be adequately protected if each nation adopts a "go-its-own-way" approach. The need for an international approach to the control of oil inputs from tankers is confirmed by the National Academy of Science report Petroleum in the Marine Environment. (See pages 236 and 237 of this EIS.) Therefore, not only is Coast Guard support of programs, including the 1973 Marine Pollution Convention, designed to maximize international cooperation in the reduction of pollution of global marine environment in conformance with its responsibilities under the statute, it is consistent with the best available scientific data on the fate of petroleum introduced into the sea.

Comment

The Coast Guard has not made a single proposal with respect to maneuverability features. Research and development and model studies are a totally inadequate response to the plain mandate of the Ports and Waterways Safety Act. Congress suggested (in 1972) a number of features which might be considered for adoption. Many of these features, e.g., thrusters, controllable pitch propellers, twin screws/ twin rudders, have been extensively studied and discussed, involve existing technology, and are available "off the shelf."

Operational experience with these features has been extensive - literally millions of hours - and seems to have proven that there are economic and pollution control benefits in their incorporation. There is need of such features to be required on coastwise tankers, and the failure of the Coast Guard even to consider them at this time is mystifying. (CLSP p.142)

Response

The statement has been revised to discuss at some length on pages 64 - 69 the problems of maneuverability and controllability of tankers. The key question is that of "the extent to which proposed regulations will contribute to safety or protection of the marine environment" (the second criteria of Title II of the Ports and Waterways Safety Act). The commonly suggested features contribute significantly to the maneuverability of boats and smaller ships. However, with respect to the vessels which will be subject to these regulations, these features would result in only minimal improvements in maneuverability. Moreover, there is no way to show, prove, or even draw a careful inference that some given increase in maneuverability would result in less oil entering the marine environment. Please refer to pages 70 and 71 for a full discussion.

Comment

Controllable pitch propellers have been estimated to provide a 25% reduction in straight line stopping distance, a capability which is most valuable in coastal and harbor situations where maneuverability is restricted. This capability, needless to say, might also prove useful on tankers loaded with Alaskan oil navigating the trecherous Straits of Juan de Fuca. (CLSP, p. 142)

Response

See pages 65-67 for discussion of stopping ability and controllable pitch propellers.

Comment

The Coast Guard has made no proposals at all in the area of tank cleaning systems or flue gas inerting.

(CLSP, p. 145)

Response

The Coast Guard published in the April 21, 1975 Federal Register a notice of proposed rulemaking requiring installation of inerting systems on tankers over 100,000 DWT and combination carriers over 50,000 DWT. Deadline for receipt of comments was June 5, 1975. Final rules will be published as soon as comments have been evaluated and necessary changes to proposed rules have been drafted.

AMERICAN PETROLEUM INSTITUTE
1801 K STREET, NORTHWEST WASHINGTON, D.C. 20006

B. H. LORD, JR., *Director*
Division of Transportation

(202) 833-5710

August 20, 1974
Re: 14.19

The Commandant (G-WEP-2/73)
United States Coast Guard
Washington, D.C. 20590

Dear Sir:

This is in reply to your letter of 26 June 1974, reference 5922/9-44. That letter forwarded a copy of the Draft Environmental Impact Statement relating to the proposed regulations to implement the Ports and Waterways Safety Act of 1972, (P.L. 92-340), Title II, as amended.

Before making detailed comments on the statement, the API would like to comment on the subject as a whole. It is realized that the Coast Guard was in an untenable position as it was drafting regulations based upon laws which were not entirely compatible. We consider that the Coast Guard's decision was a proper one. This proposal established 33 CFR Part 157 as "interim" regulations for U.S. vessels in the domestic trade. These can be supplanted at a later date with practically identical requirements for U.S. vessels in foreign trade and foreign vessels in U.S. waters in addition to the U.S. vessels in domestic trade. These requirements will be compatible with the Convention adopted by the International Conference on Marine Pollution, 1973.

In this regard we feel that the Coast Guard decision to not require double bottoms was a proper one. Some consider that double bottoms are a benefit environmentally and this may be true in some instances. However, in other cases, a double bottom can jeopardize the tanker and possibly turn a relatively minor bottom damage into a catastrophic stranding resulting in a major oil spillage. At the International Conference on Marine Pollution, 1973, a proposal to require double bottoms was formally considered on two instances and decisively voted down.

The Commandant (G-WEP-2/73)
United States Coast Guard
August 20, 1974

Page Two

In general, the API concurs with the thoughts contained in the Environmental Impact Statement. However, the following comments are offered with the belief that their inclusion in the final statement would make it a more accurate document.

1. Page 9. II. B. (9)(c) - Inasmuch as contracts have already been entered into in good faith for deliveries, some of which may be made after December 31, 1977, it is recommended that this be amended to read, "Is delivered after December 31, 1977, unless contracted for prior to December 31, 1974; or".

2. Pages 22-24. III. A., and Pages 58-59, VI. - These sections on the effects of marine oil pollution tend to overemphasize the deleterious effects of oil in aquatic biologic ecosystems. In generalizing, the author cites a number of harmful effects which are postulated or speculative, and for which the scientific evidence is either lacking or contradictory. For example, the depuration of oil from organisms placed in clean water following exposure to oil is ignored. In fact, the National Academy of Sciences has concluded that there is no evidence for the buildup of toxic hydrocarbons in the food chain, with the implied threat to human health.

   The selection of references is one-sided, in that only those which describe, or even exaggerate, the potentially harmful effects of oil in aquatic systems are cited. Many reports are available in the scientific literature which objectively assess the biologic effects of oil, including the damage during and recovery following oil spills.

   It would seem imperative that these sections of the draft be revised so that a more complete and balanced view of the subject would result. I am attaching two such reports on the subject, "Accumulation and Release of Petroleum Hydrocarbons by Edible Marine Animals" by J.W. Anderson and J.M. Neff, and "Hydrocarbons in the Marine Environment" by F.T. Weiss. These in turn reference many other papers and authors.

The Commandant (G-WEP-2/73)
United States Coast Guard
August 20, 1974

Page Three

3. Page 47. III. H. - It is considered that the five percent additional cost for the construction of a segregated ballast tanker is too conservative. Ten percent would be a more realistic estimate. Further, there will be added operating costs to move the same quantity of oil.

4. Pages 51-53. IV. 3. - It is stated that the procedures (a) and (b) are essentially the same for U.S. flag vessels. However, procedure (a) will require an unacceptable loss of ship time. Further, procedure (a) will require washing to be accomplished in a populated area rather than in isolation at sea. It is also questioned that the "clean" ballast will be of a quality that can be discharged into the waters at the loading port. This latter comment also applies to procedure (c).

5. Pages 54-55. IV. 3. - It is indicated that the fitting of double bottoms would result in a considerable saving in the amount of oil discharged due to groundings. It is true that in some instances double bottoms would prevent the discharge of oil. However, it is also a fact that in some cases the double bottoms will cause significantly more outflow than would be the case with a conventional tanker. In breaching the bottom of a conventional tanker, some cargo will escape. This will lighten the vessel which will help it to free itself. Breaching a void double bottom tank will cause a considerable loss of bouyancy which will make the vessel sink deeper making it more difficult to free itself. In heavy weather this could cause further rupturing or even a complete breaking up of the vessel, thus producing a major rather than a minor spill.

It is hoped that the foregoing will be helpful in the development of the final Environmental Impact Statement. The Institute is grateful for the opportunity to assist in this important work.

Very truly yours,

B H Lord Jr

B. H. Lord, Jr.

Attachment

Response to American Petroleum Institute

Comments in letter dated August 20, 1974

Comment

The EIS (and regulations) should be revised to change definition of "new vessel" to exclude vessels delivered after December 31, 1977, if they were contracted for prior to December 31, 1974.

Response

The dates have not been changed. The Coast Guard feels the delivery date in the proposed rules was reasonable and the same date will appear in the final rules. (See page 42 of this environmental impact statement.) While it appeared for a time that at least one vessel contracted for prior to July 1, 1974, would not be delivered prior to December 31, 1977, recent contract cancellations have eliminated the problem.

The Coast Guard representative, in response to comments on this subject at the public hearing in Washington, D.C., on July 30, 1974, stated that the Coast Guard would consider on a case-by-case basis instances where construction delays caused delivery of a vessel contracted for prior to December 31, 1974, to be delayed beyond December 31, 1977.

Comment

The sections on the effects of marine oil pollution tend to overemphasize the deleterious effects of oil in aquatic biologic ecosystems. The selection of references is one-sided, in that only those which describe, or even exaggerate, the potentially harmful effects of oil in aquatic systems are cited. It would seem imperative that these sections of the draft be revised so that a more complete and balanced view of the subject would result.

Response

Rather than attempt to present, analyze, and draw conclusions on all the available literature on fates and effects of oil in the marine environment the Coast Guard has instead chosen to refer the reader to the National Academy of Sciences report Petroleum in the Marine Environment published in January 1975. While not completely up to date because of publishing delays, it represents, we feel, the best available overview of the problem for those of us who are not biochemists or marine biologists.

The conclusions of this report are reproduced in Appendix B and the reader should refer to the report itself for details on the effects of marine pollution.

Comment

Five percent additional cost for construction of a segregated ballast tanker is too low. Ten percent is more realistic.

Response

The environmental impact statement has been revised to include a more thorough discussion of the costs of the regulations. (See pages 53 - 56.) Estimates of the increase in construction cost due to providing segregated ballast spaces range between 5% and 10% with increases in required freight rate of about 5% to 10%. As shown in Table 9, page 56, under the most pessimistic set of assumptions, these increased transportation costs are estimated to be less than 0.2 cents per gallon.

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WEP-2

August 16, 1974

Captain S. A. Wallace
Chief, Marine Environmental Protection Div.
U. S. Coast Guard (G-WEP/73)
Washington, D. C. 20590

Dear Captain Wallace:

In response to the request for comments relating to the Draft Environmental Impact Statement relating to the proposed regulations to implement Port and Water Safety Act of 1972, the enclosures set forth the American Institute of Merchant Shipping's position.

Sincerely,

James J. Reynolds

James J. Reynolds
President

Enclosures

COMMENTS OF JAMES J. REYNOLDS, PRESIDENT,
AMERICAN INSTITUTE OF MERCHANT SHIPPING
BEFORE THE U.S. COAST GUARD AT HEARINGS ON
PROPOSED REGULATIONS FOR TANKER CONSTRUCTION
AND PRELIMINARY NOTICE OF PROPOSED REGULATIONS
ON MARINE TRAFFIC REQUIREMENTS - JULY 30, 1974.

Mr. Chairman:

I am James J. Reynolds, President of the American Institute of Merchant Shipping, a trade association representing the majority of ocean-going vessels under the U.S. flag. These vessels include both cargo-carrying and tanker vessels engaged in the foreign trade of the United States and the domestic trade, servicing traffic among the various contiguous and non-contiguous States of the United States.

I would like to comment briefly on both the U.S. Coast Guard Proposed Regulations for Tank Vessel Construction listed as CGD-74-32 and the Advance Notice of Proposed Marine Traffic Requirements listed as CGD-74-77.

With respect to CGD-74-32, the Tanker Council of the American Institute of Merchant Shipping wishes to commend the Coast Guard for its good judgment in proposing construction regulations for tankers engaged in the domestic trades which coincide with the construction standards developed last year and incorporated after prolonged discussion at sessions of the Intergovernmental Maritime Consultative Organization into a Convention which is now proceeding to ratification throughout the world.

To have placed different or more demanding construction standards on U.S. vessels engaged in the domestic trades than those contemplated for the world maritime community with respect to the tankers of all nations, would have placed an unfair and unduly burdensome economic burden upon American operators in the domestic trades who might for economic reasons at some future

date wish to put their vessels either temporarily or permanently into the foreign tanker trade. We recall the detailed debate that went into the formulation of the IMCO Convention and the major part played by representatives of the United States in its ultimate terms and we believe the construction standards which finally emerged respond well to the world-wide marine environmental concern.

There is one aspect of the proposed regulations, however, which we most respectfully suggest appears to have placed an unfair burden upon a very limited number of U.S. operators who have already signed contracts for the construction of tankers to be used in the domestic trades. We refer to the definition of "New Vessel" to which the proposed regulations would apply. You will recall that such a vessel is defined as one to be constructed under a contract awarded after December 31, 1974 or, in the absence of a building contract, has the keel laid or is at a similar stage of construction after June 30, 1975, or is delivered after December 31, 1977. It has been brought to my attention that at least one Member of AIMS has indeed signed a contract not only prior to December 31, 1974 but indeed prior to July 1, 1974 and yet because of the present heavy order book being experienced by American shipyards, has no assurance that his vessel will be delivered prior to December 31, 1977.

It would seem to me, Mr. Chairman, that the type of situation to which I have alluded may very well not have been contemplated when the construction regulations were being drafted and I suggest it would be most inequitable to that particular operator, or any other, who has in good faith signed a contract for the construction of a vessel in June of 1974, to be confronted with the prospect of having to re-negotiate and re-design the vessel because of the juxtaposition of

dates which have been utilized in defining a "New Vessel". We trust that the Coast Guard with its usual good sense and dedication to fairness will take appropriate steps to modify the effective dates of the construction regulations to recognize the inequities which might be visited upon a handful of operators.

As to the Coast Guard Advance Notice of Proposed Marine Traffic Requirements (CGD-74-77), we have the following comments to make. First and foremost I wish to express the high commendation of our Members for the determination of the U.S. Coast Guard in developing its traffic requirements, to do everything possible that can be reasonably done to minimize incidents which could lead to pollution of our waters and yet I am sure you understand, Mr. Chairman, that when experienced mariners sit down to review the traffic requirements contemplated by your preliminary notice, there are bound to arise details of concern as to various aspects which they perhaps regard as too burdensome, and possibly counter-productive. Their concerns in no way should be construed as minimizing their high regard for the efforts of the Coast Guard in creating a safer marine environment and they are confident that by appropriate exchanges of views, men of good will will arrive at final regulations which will truly serve the best interests of the Nation. We respect fully that it must be the views of the Coast Guard which ultimately prevail and you can be certain they will be respected and meticulously observed.

In that spirit the following comments are offered for your consideration as areas of general concern expressed by our members in connection with the ubstance of the regulations ultimately to be proposed by the Coast Guard:

A. As stated in my letter of March 21, 1974 to Admiral Bender in connection with CGD 73-202, we are concerned over broad delegation of authority concerning control of vessel movements from the Commandant to District Commanders and Captains of the Port. Our concerns are deepened by the proposals of section 1(b) dealing with determination of hazardous areas and circumstances, coupled with the detailed factors to be evaluated at the local level. With the best of intentions, conflicting actions are being taken in various local Coast Guard jurisdictions and this quite understandably gives rise to concern among mariners that expanded delegations of authority could result in an element of confusion as to methods of control of vessel operations in navigable waters.

B. If the activities of the "pilot" and his interface with the vessel and its crew are to be reappraised, so should his qualifications, licensing, authority and responsibilities.

C. While the concepts of the equipment requirements of Section 2 appear reasonable, it must be emphasized that certain items contribute little if anything to safety in confined waterways; some items are unproven or generally unavailable; no international or domestic specifications exist for most of the equipment; such requirements extensively exceed what the U.S. has agreed to or promoted in IMCO; and coupled with the proposals of Section 1(b) such requirements could preclude vessels from entering port.

D. On December 19, 1973, we submitted detailed findings and recommendations of the Institute regarding U.S. government-produced charts, publications, and related navigation services to the Commandant, DMAHC and NOS. That document highlights the virtual impossibility of full compliance with those

proposals of Sections 2, 3 and 4 requiring use of current corrected copies of charts and publications under the systems now used for their production and dissemination.

E. The objectives of the testing requirements of Section 3 may be better achieved through different approaches with less lost ship time.

F. The manning implications, major changes in vessel operations in navigable waters and new precedents proposed by Section 4 would have serious impact on all vessels and we look forward to submitting detailed observations and suggestions on each as time permits.

We trust these areas of concern lend credence to our feelings that the concepts and details of these preliminary proposals deserve further careful consideration by both the Coast Guard and the maritime community. Since AIMS is representative of the full spectrum of ship operators, we have access to all types of applied operational and technical expertise. After the Coast Guard has had the opportunity to collate and analyze the extensive inputs from all parties at interest during these hearings, we respectfully suggest that an appropriate group of experts from within our membership meet with the Coast Guard staff for detailed discussions. There is no doubt that a viable and enforceable set of regulations toward enhancement of maritime safety can result from such an approach.

In closing, we would like to offer a comment on behalf of the international maritime community, since the proposed marine traffic requirements are of obvious importance to ship operators around the world. AIMS is pleased to be the U.S. member of the International Chamber of Shipping and the International Shipping Federation. As such we wish to report that those organizations sympathize with the

objectives of the Coast Guard, are in the process of developing detailed views from their constituencies, and are making every effort to meet the August 19 deadline for submittal of written comments. Since these views are being solicited from maritime interests throughout the world, I am sure the constraints of time are quite obvious. Yet since the proposals discussed herein will have substantial impact on all vessels trading to the United States, we have no doubt that the views ultimately submitted by the international shipping interests will receive thoughtful consideration by the Coast Guard.

The Institute stands ready to cooperatively assist the Coast Guard in the discharge of its manifold responsibilities as a world leader in marine safety, marine environmental protection, and knowledgeable maritime law enforcement. We look forward to the continuing opportunity to do so in connection with advancement of these proposals to their final form.

tanker double bottoms YES or NO?

In the past three to four years numerous proposals have been made for protecting the marine environment from oil pollution by tankers. In AIMS' view, the most important of these have been tentatively agreed at a landmark 79 nation IMCO conference held in London last fall which drafted "The International Convention for the Prevention of Pollution from Ships, 1973."

One measure not accepted at the IMCO conference, yet frequently suggested in the United States is a mandatory requirement that new tankers be built with double bottoms. Double bottom advocates have continually stressed that this construction feature would prevent a very high percentage of oil being spilled when tankers strike the bottom. Despite strong technical arguments to the contrary, opposition to mandatory tanker double bottom requirements is frequently attributed solely to oil and shipping interests, who are described in the U.S. as being motivated only by economic concerns and as having a callous disregard for environmental protection.

Careful review of the basic technical factors and all available accident records leads us to a very different conclusion:

> While there are substantial advantages, primarily operational, for double bottoms in passenger and dry cargo ships, by and large these would not be applicable to tankers.

> While double bottoms in tankers might be directionally helpful in some minor grounding accidents in preventing oil outflow, they would offer no protection in more serious accidents currently producing over 60% of oil spilled in tanker groundings, and conceivably they could increase the amount of oil spilled.

> There are a number of operational and traffic measures available with high potential for preventing accidents of all types involving

existing as well as new ships. Mandatory adoption of such measures represents a far more effective approach to preventing accidental pollution from tankers than the use of mandatory double bottoms in new tankers.

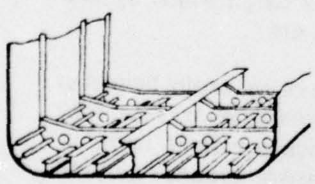
Based on these factors which are developed further herein, we are opposed to a mandatory requirement for double bottom construction in new tankers. We feel the use of double bottoms in new tankers should continue to be optional since there are circumstances under which this construction will be found desirable operationally.

AIMS feels that it is time to speak out on the double bottom issue in a direct and candid fashion. We hope by so doing to help resolve the issue on supportable technical grounds, and not simply on the basis of public appeal.

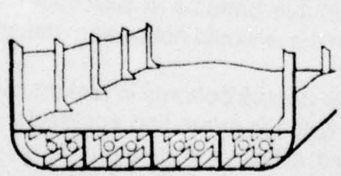
What is a Double Bottom and Why is it Used?

A double bottom is a cellular construction at a ship's bottom in which a flat inner skin, or tank top is placed above and parallel to the ship's bottom covering the bottom framing members. This construction results in a series of "double bottom" tanks underneath the vessel's cargo holds and machinery spaces, and it also affords a flat tank top, or floor, on which dry cargo can conveniently be loaded.

Without the double bottom and its smooth tank top, the bottom of a ship's hold would be a maze of interconnecting structural members more or less resembling the underside of a large steel highway bridge--a structure totally unsuitable for storing dry cargo. The requirement for a smooth floor or deck on which to place cargo is the fundamental reason why so many ships have double bottoms. It is a practice adopted late last century in the early days of iron ships.

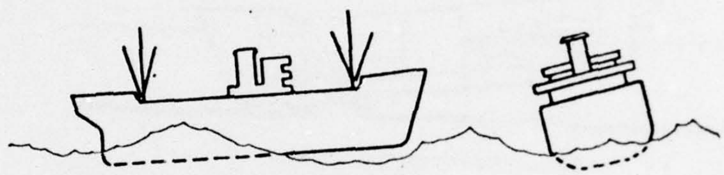


Single bottom
Tough to stow cargo

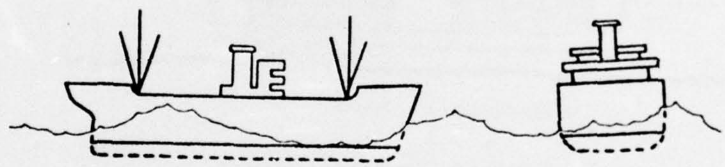


Double bottom
Smooth top-Messy below

Another important advantage to double bottoms is that they provide the ideal place for carrying liquid ballast and fuel in dry cargo and passenger vessels. Most ships when not loaded with cargo must take on ballast preferably near the bottom, to maintain stability and reduce susceptibility to overturning.



Empty ships are unsafe ships

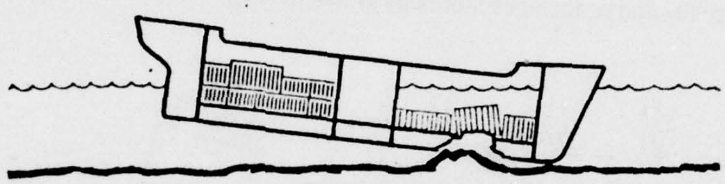


Ballasted ships are safe ships

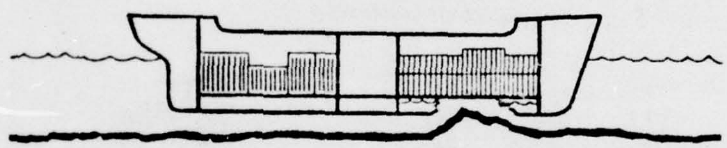
The Safety Factor and Double Bottoms in Cargo Ships

While ease of cargo stowage and ballast capability are the two basic reasons for using double bottoms in the vast majority of passenger and cargo ships, this construction was long ago found to provide an additional safety factor for dry cargo ships. In grounding accidents where the smooth top of the inner bottom is not pierced or ruptured, the ship does not lose nearly as much buoyancy, or settle as deeply into the water, as it would if a full cargo hold is breached. This is of particular importance to dry cargo and passenger ships as contrasted to tankers since the holds of these non-tankers are not only very large in comparison to tankers but they provide little resistance to flooding from the sea. Even the loaded hold of a dry cargo ship resembles a warehouse or storeroom which has a great deal of empty volume

around the cargo. When these spaces are flooded a ship will settle very deeply in the water. This can directly endanger its ability to stay afloat, or complicate efforts to salvage a grounded vessel partially full of water. Accordingly such ships have frequently been "floated in" on their double bottoms when they remain intact.



Serious flooding may sink this ship



Double bottom may save this ship

Conventional Tankers and Groundings

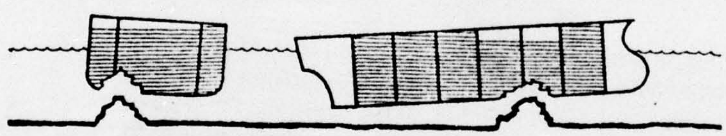
The situation is entirely different when a conventional loaded single bottom tanker grounds. If there is a hole in the bottom of loaded cargo tanks, rather than sinking deeper into the water, or settling more firmly on the bottom, the tanker actually rises slightly out of the water. Since it becomes more buoyant it will generally be easier to salvage than it would be if empty tanks had been pierced. This happens with a tanker because most of the oil in the pierced cargo tanks will remain inside the ship floating on top of the water due to pressure at the bottom without any loss of buoyancy. A relatively small amount of oil will escape to the sea from fully loaded tanks until the pressure of the lighter oil inside the pierced tank is equal to the outside water pressure at the bottom. It is the minor oil loss which by reducing the loaded weight of the tanker causes it to rise slightly out of the water. This factor, together with the greater number of cargo

holds or compartmentation in tankers, has generally made tankers far more able to withstand grounding, and collision damage than ordinary dry cargo ships—a fact clearly supported by total loss accident records for the two types of ships. Lloyds records for recent years clearly demonstrate this point.* By comparing total losses in relation to ships at sea of each type the records indicate:

> over 4 times as many dry cargo ships are wrecked as a result of grounding as tankers

> nearly 9 times as many dry cargo ships founder (flooding loss at sea) as tankers.

> over 2 times as many dry cargo ships are lost following collisions as tankers.



Loss of cargo - Ship rises

Tankers and Double Bottoms—Will it Work?

What then would the situation be if a double bottom construction were used for tankers? At first glance it would appear to be "the best of all possible worlds" combining the inherent double bottom safety factor found by many years of dry cargo ship experience with the greater compartmentation and flooding resistance traditionally found in tankers. To the extent that this could happen without any harmful side effects it would seem to benefit both the tanker's own safety, and to minimize oil outflow to the sea.

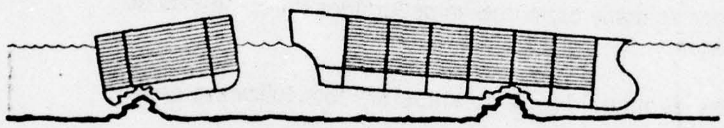
Unfortunately, it appears likely that there will be several substantial and harmful "side effects."

*"Analysis of World Merchant Ship Losses," W. J. Beers, formerly Editor of Statistics, Lloyds Register of Shipping, RINA, 1968.

Greater Sinkage and Less Stability with Double Bottom

Putting *empty* double bottom tanks beneath the length and breadth of a loaded tanker *ensures* that in any grounding where the bottom is pierced the tanker will sink deeper into the water, *even* if its cargo holds are not ruptured.* Because of flooding in empty double bottom tanks the tanker will almost certainly heel or lean over substantially to one side or the other, further complicating its problems or impaling it on the bottom. It is crucial to recognize that quick action to free and float a grounded ship before it can break up and spill its entire cargo is nearly always the key to successful salvage.

After Bottom Damage



Flooded double bottom - Loss of buoyancy - Ship settles deeper

A firmly grounded double bottom tanker might therefore have to jettison substantial amounts of oil cargo in order to be saved from catastrophic loss and major pollution of the seas. For the double bottom tanker to maintain buoyancy and stability equivalent to the single bottom tanker, the amount of oil which would have to be transferred to a lightering vessel, or jettisoned if no lighter is available, may well be 6-8% of its total cargo. This equates to roughly 15-30,000 tons for a single VLCC—an amount roughly ¼ to ½ the *total* oil outflow from *all* tanker groundings in a given year. Obviously if the double bottom vessel cannot be quickly salvaged, and breaks up even partially, the potential oil spillage could greatly exceed total worldwide spillage of some 50,000 tons which the U.S. Coast Guard currently estimates from tanker groundings.

*The sinkage problem will also be a factor in new segregated ballast tankers with empty ballast tanks. Since the probability of rupturing these tanks is only 20-30% of that with double bottoms however, it is an acceptable drawback in the segregated ballast concept which has other significant advantages.

What Do Accident Records Show about Double Bottoms?

While the circumstances described above assume that the inner bottom of the grounded tanker would not be ruptured, experience shows that in many groundings the inner bottom probably would be breached. In fact, the more extreme or serious the grounding, the more likely this would be, and here again U.S. Coast Guard data,* and logic, show that it is these very serious accidents which produce the great majority of oil released accidentally. Some other relevant figures are worth recording:

> IMCO has estimated that in 57% of dry cargo ship strandings a double bottom tank *has* been breached despite the fact that in something less than 20% of these accidents was estimated bottom penetration equal to or greater than the height of the double bottom. There seems to be a clear, and logical implication that because of the integral structural connection between the two skins, initial damage to only the outer bottom itself can distort and tear the inner bottom.

> *The U.S. Coast Guard* in expanding on the IMCO work estimated that a lesser amount of oil might flow out of a double bottom than a single bottom ship even if both were holed under similar circumstances. Overall this led them to conclude that the tanker double bottom might be roughly 60% effective—that is, it might save 60% of a total 50,000 tons lost in groundings each year—or a maximum of 30,000 tons annually.**

None of the above estimates reflect the following vital points:

> Any single incident in which a double bottom tanker has salvage or stability difficulties of the type described above might cause a greater oil spillage than the total estimated savings for all ships in any given year.

*U.S. Coast Guard estimates from Dept. Transportation, U.S. Coast Guard Draft Environmental Impact Statement, Pursuant to Section 102(2)(c), P.L. 91-190, etc., June 1974.

**In later estimates presented in 1973/4 the Coast Guard upped their estimates of effectiveness to 90%, or 45,000 tons saved annually. It was also acknowledged, however, that "present conventional single skin construction was at least 75% effective in preventing plating rupture."

> The severity of a grounding is crucial in regard to oil spillage. Coast Guard data for 1969-72 show that of 171 groundings causing oil outflow, only 13, or 8%, resulted in total ship loss. This 8% of incidents however produced over 60% of the oil spillage from all groundings.

> Over 60% of the groundings incidents, and 50% of those causing oil outflow have occurred in shallow and narrow harbors and entrances to which crude tankers are increasingly unable to trade, thereby removing them from the most accident-prone surroundings.

> The fact that groundings, however important, have accounted for less than 22% of the accidental oil released from tankers.

> The fact that other accident prevention and safety measures such as traffic control, better personnel training and licensing procedures, and new navigational equipment hold very high potential for reducing not only grounding but collision accidents as well.

In our view, the conclusion to be drawn from these factors is inescapable. Tanker double bottoms can probably mitigate spillage in a number of minor groundings currently accounting for on the order of 20,000 tons per year. They would almost certainly, however, turn a small number of initially minor incidents into major or catastrophic losses, thereby increasing the amount of oil spilled from tanker groundings.

Possible Double Bottom Safety Hazard in Tankers

There is an additional safety consideration. Both crude oils and many refined products which constitute upwards of 85% of petroleum moved by tankers can produce highly explosive vapors in confined spaces. Despite the most rigorous construction and maintenance procedures leaks can and do occur, particularly in the internal structure of all types of ships. If double bottoms were placed beneath cargo tanks there is always the possibility that some oil cargo will leak into these empty spaces and produce explosive and toxic vapors representing a hazard both to people and to the ship itself. Though frequently cited as evidence of no safety problem, the experience with dry cargo ships carrying

fuel in double bottoms is irrelevant. Normal ship bunker fuel produces no explosive vapors and in fact usually won't even burn if a match is dropped in it. Many large crude tankers now use inert gas to protect against the explosion hazard, and this technique could be used in tanker double bottom spaces. It would, however, only compound the personnel problems, and because of the catacomb-like structural arrangement in double bottom tanks, there is no assurance that inert gas procedures would represent as effective an explosion precaution measure as it does in conventional cargo tanks.

Are Double Bottoms Ever Desirable for Tankers?

Despite these factors, there have been and will continue to be circumstances in which certain types of smaller tankers will find double bottoms operationally advantageous, despite the complications they present in serious grounding. For small "drug store" tankers and specialty ships which carry many different cargo grades over short distances, a double bottom may facilitate faster cargo handling, due to better tank drainage. The smooth tank bottom can also minimize the need for tank washing which is difficult for these specialty ships in short coastwise service. Lastly, because of their smaller size, the possible salvage complications following grounding described above are not likely to be nearly so severe for smaller vessels as for larger crude tankers. For these operational reasons, AIMS would not agree with the suggestion by one influential delegation at the opening of the 1973 IMCO conference that double bottoms should be outlawed for tankers. Rather we feel use of this construction should continue to be optional and be adopted for those circumstances where sound operational reasons indicate its value to help in cargo drainage, or tank washing particularly in short coastal voyages.

Some Views on the Tanker Double Bottom

Having described the major technical considerations, let's review some significant viewpoints expressed over the last four years of the "double bottom debate."

In a report of comprehensive hearings issued by the Senate Committee on Commerce on March 28, 1972 there is the statement:

"*Double Bottoms*. Perhaps the clearest instance of a standard presented at the committee's hearings that must be seriously considered, is that of double bottoms. Groundings, such as that of the *Torrey Canyon,* can be serious causes of catastrophic oil spills."

There seems to be the clear implication here that the Senate Commerce Committee felt double bottoms might be effective in an accident as extreme as the *Torrey Canyon* disaster. Yet in hearings before the House Committee on Merchant Marine and Fisheries on June 6, 1973 a Coast Guard witness stated categorically that the double bottom construction would not have saved the *Torrey Canyon*. Their testimony generally supports industry views that it would be of little use in what Coast Guard described as "high energy" groundings--that is, the high speed, serious accidents. As previously noted, it is the small number of serious accidents which historically have produced 60% of grounding spillage.

Turning to the question of additional cost so often cited as the basis for objections to fitting double bottoms, the 1972 Senate Commerce Committee hearings concluded "that the additional cost of double bottom construction would be approximately 4% (but) the Committee also received somewhat higher estimates." The Committee went on further to state "even the highest of these estimates would be a minuscule factor in terms of petroleum cost because of the tiny proportion of total petroleum cost that is represented by tanker transport."

These values may be contrasted with estimates supplied by the Coast Guard for the House Merchant Marine and Fisheries hearings a year later in which a percent cost increase of 8¾% was presented. Furthermore the House Committee, referring to long haul crude tanker traffic, estimated transportation cost at "about 20% of the total cost as a minimum of landed product."

While AIMS believes the higher Coast Guard estimates to be

more nearly correct, we also believe that capital increments of this order would not represent an unreasonable burden for industry or consumers—*if the double bottom could assuredly do what its advocates feel it could*. Faced, however, with the prospect of little improvement at best, the additional cost and additional steel requirements on the order of 6,000 tons for each double bottom tanker of 200,000-300,000 tons, represent a wasteful misuse of capital and steel at a time of pressing shortages of each.

Finally, it is important to consider how marine regulatory experts outside of the United States view this proposal from an environmental protection viewpoint. On his return from the 1973 IMCO Marine Pollution Conference the leader of the U.S. delegation, the Hon. Russell Train, appeared before hearings of the Senate Committee on Commerce held on November 14, 1973. In reference to questions about the IMCO decision *not* to require double bottoms, Mr. Train said:

"While I was not present in the technical committee where most of this discussion took place, I think it is fair to say that there is a very strong difference of opinion with the United States on the subject of double bottoms. Not simply from the standpoint of the additional costs involved, but I gathered real differences of opinion as to effectiveness of double bottoms as a means for reducing accidental discharges.

"There were those who feel, for example, that with double bottoms if a ship goes on a reef and the double bottom is breached and fills with water, even though this is not mixing with oil and there may be no discharge of oil at that point, the ship will settle more positively, if that is the phrase, upon the reef and be that much more difficult to get off.

"It may well be that the use of the double bottom in such cases could be a detriment rather than an advantage in terms of protecting the seas."

In our view Mr. Train summarized very well the principal points made by the world's marine regulatory experts. At the IMCO deliberations U.S. proposals for mandatory double bottoms were put to a vote on two occasions. They were both defeated, first by a vote of 22 to 9 as a requirement for larger tankers, and later by a vote of 21 to 5 for the smaller tankers.

Summary

The preceding discussion covers generally all significant arguments made both for and against a requirement for double bottoms in tankers. It will never be possible to absolutely prove whether or not this construction would provide at least some measure of protection or whether it would turn out to be a step backwards in preventing oil pollution of the seas. The preponderance of actual evidence and technical information strongly suggests that double bottoms would be of no value whatsoever in major grounding accidents which though fortunately small in number cause the larger share of oil spillage from groundings.

Though not discussed herein, it seems clear that other measures now receiving serious consideration can definitely bring about a positive reduction in *both* grounding and collision accidents in the most sensitive coastal areas, and be applicable to all tankers, not just new ones.

Chief among these measures with high potential for preventing accidents are:

> Harbor traffic control using shore radar and positive communications with all ships.

> Better ship navigational equipment for position fixing and communication.

> Improved training programs for personnel.

The potential for preventing accidents by such measures should be obvious, but has only recently been recognized in the United States. AIMS supports steps in this direction now being taken by our Coast Guard and looks for them to be effective in the near future. Such steps based on sound technical and human engineering should be pursued as a matter of high priority.

July 1974

Response to American Institute of Merchant Shipping

Comments in letter dated August 16, 1975

Comment and Response

In response to the Coast Guard's request for comments on the Draft Environmental Impact Statement, the American Institute of Merchant Shipping (AIMS) submitted a written text of the statement made by Mr. James J. Reynolds, President of AIMS, at the July 30, 1974, public hearings on the proposed regulations and a copy of a booklet published by AIMS entitled "Tanker Double Bottoms - Yes or No?" Both of these items have been reviewed and considered in the course of revising the draft EIS. Many of the matters addressed are the same as those raised in comments by the Department of Commerce and the American Petroleum Institute and responses to these are found on pages 103 and 185. The matter of double bottoms is discussed on pages 72-76.

NATIONAL AUDUBON SOCIETY

950 THIRD AVENUE, NEW YORK, N.Y. 10022 (212) 832-3200 Cable: NATAUDUBON

August 6, 1974

Captain Richard Brooks
Executive Secretary
Marine Safety Council (G-CMC/82)
Room 8234
U.S. Coast Guard
Washington, D.C. 20590

Captain S.A. Wallace
Chief, Marine Environmental Protection Division
U.S. Coast Guard (G-WEP/73)
Washington, D.C. 20590

Dear Captain Brooks and Captain Wallace:

The National Audubon Society has reviewed the interim rules and regulations for protection of the marine environment relating to tank vessels engaged in domestic trade, which were published in the Federal Register June 28, 1974. We have also reviewed the draft environmental impact statement that discusses those interim regulations.

We are combining our comments on the interim regulations and the draft impact statement in this letter, a copy of which is being sent to each of you.

On January 26, 1973, the Coast Guard published in the Federal Register an advance notice of proposed rulemaking under the Ports and Waterways Safety Act of 1972. The advance notice stated that the Coast Guard was considering proposing regulations "which would require a segregated ballast capability" on tank ships, and that the "segregated ballast capacity would be achieved in part by fitting, throughout the cargo length, a double bottom..."

We were pleased to note at the time that the Coast Guard was considering such regulations to protect the marine environment from oil pollution, and our Washington representative, Ms. Cynthia E. Wilson, transmitted our views to the Coast Guard in a letter dated March 8, 1973, in which we urged the Coast Guard to issue such regulations.

On July 5, 1973, the Coast Guard published in the Federal Register a supplement to the advance notice of rulemaking in which it was announced that further action was being deferred pending the outcome of the October, 1973 International Conference on Marine Pollution.

The interim regulations published June 28, 1974 constitute a resumption of the rulemaking process announced on January 26, 1973.

And, we regret to say, the interim regulations published June 28, 1974 also constitute a retreat by the Coast Guard from the segregated ballast and double bottom approach orginally contemplated.

We recognize that when implemented, the interim regulations issued June 28 are likely to bring about a reduction in the amount of oil pollution from tankers, and we applaud you for that small step forward. But the interim regulations are needlessly timid and too small a step forward.

Moreover, the first notice of proposed rulemaking, in January, 1973, indicated that the Coast Guard was considering applying the segregated ballast and double bottom requirements to tank barges as well as tank ships. The June 28 notice contained the unhappy news that barges are not covered by the interim regulations.

We do not pretend to have expertise in the design, construction, and operation of oil tankers and barges. However, we are somewhat familiar with the studies and reports published by the Coast Guard and others on this subject. And those studies and reports make it clear that technology is now available to require greater protection of the marine environment from oil pollution by tankers and barges than the Coast Guard is requiring in its interim regulations.

The interim regulations require segregated ballast tanks only for new tankers of 70,000 tons deadweight or more. Smaller tankers and all barges are not required to have segregated ballast tanks. Oily discharges from new vessels will be limited to a maximum of 1/30,000 of the cargo. And double bottoms are not required.

As a result, the regulations will assure continuation of unnecessary oil pollution of the marine environment in normal operations, albeit to a lesser degree than now prevails. And because of the failure to require double bottoms, the regulations will assure continuation of the unnecessary threat of catastrophic pollution in event of the grounding or collision of a single supertanker without a double bottom.

In sum, the interim regulations are inadequate. We question the implication in the preamble to the regulations that the United States cannot do more, now, to reduce oil pollution of the marine environment because, in part, of the limitations of the International Convention for the Prevention of Pollution of the Sea by Oil. The United States in the past has taken the initiative on oil pollution control by enacting more stringent regulations for oil operations within our national jurisdiction

than other nations. We believe the United States should now take the lead and do the same for tank vessels operating within our jurisdiction or carrying the U.S. flag abroad.

We therefore urge the Coast Guard to reconsider the interim regulations with a view to requiring segregated ballast and double bottoms for all new tankers, and similar or other appropriate pollution control requirements for barges.

We now want to comment on the draft environmental impact statement.

On Page 5, the draft statement says: "The proposed regulations require such (oil-water separating and filtering) equipment; but the installation of the equipment will not be required until after the effective date of regulations publishing specifications, testing, labeling and approval procedures for the equipment."

There is no indication when the necessary regulations will be issued. What is the anticipated date of publication of the necessary regulations? What is the anticipated date for the mandatory use of the equipment? We urge that the regulations be published and made effective as soon as possible.

On Page 54, the draft impact statement says: "Segregated ballast for all tankers would help to eliminate the problem of oil residues to a certain degree, but the economic consequences of this alternative for the U.S. tank fleet are unreasonable."

The "economic consequences" are not detailed, however. What would be the added cost of building segregated ballast tanks into new ships? What would that additional cost for environmental protection amount to per barrel of oil? Per gallon of gasoline to the consumer?

We agree with the comment that "present levels of oil pollution represent a serious threat to the marine and coastal environment." (Page 22.) And because of that threat, we cannot agree with the Coast Guard's decision not to require segregated ballast for all tankers and not to require double bottoms on new vessels. And we must take exception to comments in the draft statement that attempt to rationalize the Coast Guard's decision not to require double bottoms.

On Page 5, the statement says: "The large number of existing vessels would preclude any immediate significant reduction in oil outflow due to requiring double bottoms on new vessels."

Of course there would be no "immediate significant reduction" in oil pollution if double bottoms were required, for as the draft statement notes on Page 55: "Deliveries of newly ordered double bottom tankers, resulting from the imposition of a double bottom requirement, could not be reasonably expected before 1978."

But the point is that regulations issued today should be based on

planning for the future. By not requiring double bottoms on new vessesls, the Coast Guard is shunning its responsibility and discarding an opportunity to minimize oil pollution in the future.

As for what is a "significant" reduction in oil pollution, any reduction of what is already "a serious threat to the marine and coastal environment" is a desirable goal.

On Page 55, the draft statement mentions projected world oil transportation needs into the 1990's. However, the source of the projections is not given and no data is given to support the Coast Guard's conclusions.

On Page 35, the draft statement notes that in 1972 "U.S. flag ships discharged 496 tons in 5 separate casualties." The draft statement then says: "It is clear from the above that a double bottom fitted only in U.S. tank ships in the domestic trade would prevent only a fraction of the total outflow and that efforts in preventing casualties should be emphasized." The statement also says: "Using a data base of one year may be misleading in that it may represent an exceptionally favorable year with respect to U.S. tank vessel accidents."

We agree that using the figures for only one year may be misleading. Thus we wonder if 1973 and early 1974 figures are yet available? But more importantly, we question the Coast Guard's decision not to require double bottoms on the basis, in part at least, of what may admittedly be a "misleading" data base.

And we also question why double bottoms need be "fitted only in U.S. tank ships" when, as the draft statement says on Page 1, "the Coast Guard must extend the applicability of these proposed regulations to encompass U.S. tank vessels engaged in foreign trade <u>and foreign tank vessels entering the navigable waters of the United States</u>" before January 1, 1976. (Emphasis added.) It is therefore clear that requiring double bottoms would prevent more than is implied by the phrase, "only a fraction of the total outflow."

Similarly, on Page 56, the draft statement says: "Oil outflow would only be significantly reduced if a U.S. vessel engaging in domestic trade were involved in the casualty." On the face of it, that has to be considered misleading since the Coast Guard must, by January 1, 1976, apply the regulations to foreign tank vessels entering U.S. waters.

On Page 37, the draft statement notes that areas within fifty miles of land "are most ecologically sensitive and most subject to the pejorative effects of oil." On Page 44, the draft statement says that "construction of large tank vessels ... could lead to the possibility, in the event of a single accident, of catastrophic environmental pollution." On Page 48, the draft statement says: "Given the potentially deleterious effects of oil pollution, this level (65,000 tons of oil pollution annually) is clearly unacceptable."

We submit that those statements can be used to justify a requirement for double bottoms. Supertankers as large as 476,025 tons already sail

the oceans. Even larger tankers are on order. In not too many years, supertankers may well be bringing oil to offshore deepwater "ports" or terminals in U.S. waters. If the Coast Guard considers 65,000 tons of oil pollution annually "clearly unacceptable," what of a single accident involving a tanker of 100,000 or 200,000, or 300,000, or 400,000 tons or more, in the "ecologically sensitive" coastal waters of the United States? It would indeed be a case of "catastrophic environmental pollution."

(We don't know whether a double bottom would have prevented the tanker Torrey Canyon from spilling its oil into the sea when it went aground in 1967. But we do know that at least one tanker with four times greater capacity than the 117,000-ton Torrey Canyon is already sailing the seas.)

On Page 2, the draft statement says that the Coast Guard received many comments on "the high initial cost associated with double bottoms." What is the additional cost of building a tanker or a barge with a double bottom? What does that cost come to, in the case of a 400,000-ton tanker, in terms of additional cost per gallon of gasoline to U.S. motorists?

On Page 51, in discussing the alternative of "more stringent requirements than the 1973 Convention," the draft statement says: "Stricter measures could certainly be construed by foreign observers as a portent of the future and evidence of intent of the U.S. government not to abide by the provisions of the Conference agreement." (Emphasis added.) On Page 53, the draft statement notes that "zero discharge" has been stipulated by the Department of the Interior for tank vessels that will transport oil from the Alaska pipeline terminal at Valdez. (Indeed, the permit for the Alaska pipeline contains this stipulation: "It is the policy of the Department of the Interior that there should be no discharge of oil or other pollutant into or upon lands or waters.")

We want to make several points here. First, we find it difficult to believe that "stricter measures" of oil pollution control by the United States would be considered evidence of intent "not to abide" by the Convention. "Not to abide" surely means not to act in accord with the Convention in the sense of failing to meet its minimum requirements, of doing less than the Convention mandates. Second, if stricter requirements for tank vessels operating in U.S. waters would be considered as evidence of intent "not to abide" by the Convention, isn't the "zero discharge" requirement for tankers that will haul oil from Valdez also an intent "not to abide" by the Convention? And third, is there any provision in the Convention that prohibits a nation from setting stricter standards for its own flag vessels or its own waters?

Moreover, we note with interest what Senator Warren G. Magnuson and Senator Norris Cotton, chairman and ranking minority member, respectively, of the Senate Commerce Committee, said in their March 13, 1973 letter to Admiral Bender: "Requiring that new tankers incorporate segregated ballast tanks and double bottoms, and be capable of retaining wastes on board for shoreside disposal is wholly consistent with the purposes of that Act (P.L. 92-340, the Ports and Waterways Safety Act of 1972) and will make a significant contribution to protection of the marine environment."

The draft impact statement says on Page 51 that if the U.S. would enact stricter measures than required by the Convention, "ultimately this would encourage other nations to establish unilateral requirements, to the detriment of a coordinated international approach."

If, by imposing stricter standards, the United States or any other nation would stimulate stricter standards by other nations, we suggest that would be an excellent way to stimulate the slow-moving IMCO to greater and faster action than it has so far demonstrated. A coordinated international approach is certainly desirable. But we should accept the reality that international organizations move forward slowly and ponderously. The international Convention should be viewed as the minimum for all nations to follow, not as the maximum. And certainly the United States, which has so often proclaimed leadership in pollution control and environmental protection, and which is the free world's largest user of oil, should take the leadership in protecting the environment from pollution by oil.

The Coast Guard itself noted in the draft impact statement that "present levels of oil pollution represent a serious threat to the marine and coastal environment." Half-measures are not enough to defuse that threat.

In sum, the draft environmental impact statement -- like the interim regulations -- is inadequate. The impact statement and the regulations seem to be motivated more by cost and political considerations than by environmental considerations.

We urge that the interim regulations be strengthened and that a new adequate environmental impact statement be issued.

In past meetings of international and regional organizations, the United States has proposed a policy of no oil discharges whatsoever anywhere in the world. Our nation cannot impose that standard throughout the world, of course. But our nation can and should require zero discharge of oil by all tank vessels operating within U.S. waters and by all U.S. flag ships operating anywhere in the world. And to the degree that zero discharge technology is available, it should be used -- and as soon as possible.

The oceans, Homer wrote, are "the source of all." We must protect that source -- of our water, of much of our oxygen, of much of our protein -- from oil pollution to the greatest degree possible.

Sincerely,

Elvis J. Stahr
President

P.S.: We continue to associate ourselves with the views presented on our behalf by the Center for Law and Social Policy at the hearings on July 31, 1974.

EJS:SMS

c.c.: Senator Warren Magnuson
Representative Leonor K. Sullivan
Senator Norris Cotton
Representative John M. Murphy
Secretary of Commerce Dent
Secretary of Interior Morton
Administrator, Environmental Protection Agency
Chairman, Council on Environmental Quality
Admiral Chester R. Bender, Commandant, U.S. Coast Guard

Response to National Audubon Society Comments

Contained in letter dated August 6, 1974

Comment

We recognize that when implemented, the interim regulations passed June 28 are likely to bring about a reduction in the amount of oil pollution from tankers, and we applaud you for that small step forward. But many studies and reports make it clear that technology is now available to require greater protection of the marine environment from oil pollution by tankers and barges than the Coast Guard is now requiring in its interim regulations. The interim regulations are inadequate. As a result, the regulations will assure continuation of unnecessary oil pollution of the marine environment in normal operations, albeit to a lesser degree than now prevails. And because of the failure to require double bottoms, the regulations will assure continuation of the unnecessary threat of catastrophic pollution in event of the grounding or collision of a single tanker without a double bottom.

(AUD, p. 210)

Response

At issue here is the question of how fast efforts to reduce or eliminate oil pollution should proceed, and whether we should have a cooperative international (slower) effort or a "go-it-alone" unilateral (faster) program.

The Coast Guard believes that U.S. participation and leadership in an international program, supplemented where appropriate with special national requirements, will be the most effective alternative in the long run and provides a reasonable protection of the marine environment.

On the basis of this belief, the Coast Guard is issuing regulations implementing provisions of the 1973 Marine Pollution Convention for U.S. tank vessels in domestic trade, with the announced intention of applying similar regulations to U.S. tank vessels in foreign trade and foreign vessels entering U.S. waters in 1976. The Coast Guard will continue to participate in IMCO marine pollution meetings and to urge stronger international requirements where necessary and practical. Efforts to evaluate and establish appropriate national requirements which supplement and complement Convention requirements will also continue.

Comment

There is no indication when regulations on oil-water separating equipment and oil-content monitors will be issued. What is the anticipated date of publication of the necessary regulations? What is the anticipated date for mandatory use of the equipment? We urge that the regulations be published and made effective as soon as possible.

Response

It is still not possible to give a firm date for publication of regulations for oil-water separators and oil-content monitors. Work has been underway over the past year on development of test specifications and steps to provide equipment test facilities. The Coast Guard has been working with appropriate facets of the U.S. marine industry and other government agencies and also with the Marine Environmental Protection Committee of IMCO. Although the delay is frustrating, the Coast Guard feels that regulations must be based on facts and that developing and carefully testing good specifications is essential. Once specifications have been published and devices tested and approved, a better assessment can be made as to a reasonable deadline for mandatory installation and use of the equipment.

It should be pointed out, however, that many vessels are already being equipped with oily water separators to treat oily bilgewater. Most of the world's tankers are also using load-on-top techniques, most without the benefit of oil content monitors. While oil content monitors will improve and make load-on-top (or, more properly retention-on-board) easier and more effective, the improvement is small compared to the much larger improvement resulting from a tanker operator's commitment to use LOT methods at all. The greatest improvement will come from rapid adoption of the discharge criteria contained in the 1973 Marine Pollution Convention, their entry into force as international law, and the effective enforcement of that law.

Comment

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Comment

The economic consequences of requiring segregated ballast are not detailed. What would be the added cost of building segregated ballast tanks into new ships? What would the additional cost for environmental protection amount to per barrel of oil? Per gallon on gasoline to the consumer?

(AUD, 211)

Response

The draft environmental impact statement has been revised to include a more thorough discussion of the costs of the regulations (including segregated ballast). (See pages 53 - 56 .) Estimates of the increase in construction cost due to providing segregated ballast spaces range between 5% and 10% with increases in required freight rate of about 5% to 10%. As shown in Table 9, page 56, under the most pessimistic set of assumptions, these increased transportation costs are estimated to be less than 0.2 cents per gallon.

Comment

We find it difficult to believe that "stricter measures" of oil pollution control by the United States would be considered by foreign observers as evidence of an intent "not to abide" by the Convention. If stricter requirements for tank vessels operating in U.S. waters would be considered as evidence of intent "not to abide" by the Convention, isn't the "zero discharge" requirement for tankers that will haul oil from Valdez also an intent "not to abide" by the Convention? Is there any provision in the Convention that prohibits a nation from setting stricter standards for its own flag vessels or its own waters?

(AUD, p. 213)

Response

The phrase "not to abide" used in the draft EIS was a poor choice of words. There is nothing in the Convention prohibiting a nation from setting stricter standards for its own vessels or its own waters, and any nation doing so would certainly be "abiding" by the Convention.

The thought that we meant to convey is that there is a possibility that the 1973 Marine Pollution Convention will not be adopted and come into force worldwide. (It must be ratified by at least 15 nations which must among them control 50% of the world's gross registered tonnage.) The United States is not a "world power" in terms of shipping, but we have been a leader in international pollution control efforts. We fought hard for a stronger agreement at the 1973 Marine Pollution Conference - without our efforts the results might have been much weaker. Other nations will be looking to us to see what we are going to do - adopt and implement the Convention, or unilaterally pursue our own course of setting stricter construction standards. Because of the size and character of the worldwide tanker oil pollution problem and the results achievable through the Convention, adoption and implementation of the Convention must be the first order of business. And the actions we take must send that message to the world's major shipping nations.

The Valdez "zero discharge" standard is an operational requirement applicable to one specific loading port, which is quite a different matter from one nation setting construction standards that will prohibit or restrict certain vessels from being used in certain trades. In view of this, and since the Valdez trade is restricted to U.S. ships, the Coast Guard does not see how the Valdez requirement could affect foreign impressions of U.S. intentions. What we do about adopting and and implementing the 1973 Marine Pollution Convention is very important to foreign attitudes and the fate of the Convention.

Comment

If, by imposing stricter standards, the United States or any other nation would stimulate stricter standards by other nations, we suggest that would be an excellent way to stimulate the slow-moving IMCO to greater and faster action than it has so far demonstrated. A coordinated international approach is certainly desirable. But we should accept reality that international organizations move forward slowly and ponderously. The International Convention should be viewed as a minimum for all nations to follow, not as the maximum. And certainly the United States, which has so often proclaimed leadership in pollution control and environmental protection, and which is the free world's largest user of oil, should take the leadership in protecting the environment from pollution by oil.

(AUD, p. 214)

Response

The Coast Guard feels that a coordinated international approach is both desirable and essential. We have tried to explain why, because of the nature of the tanker oil pollution problem, we feel such an approach is essential. (Please refer to pages 3 thru 8 .) If imposing stricter standards would inspire other nations to do the same or spur IMCO to greater and faster action, the Coast Guard would favor it. But, as indicated on page 7, the Coast Guard does not think that would be the effect of such action. The Coast Guard agrees that international organizations seem to move forward at an almost unbearably slow pace sometimes, and that the 1973 Marine Pollution Convention should be viewed as a minimum for all nations to follow. But the Convention will not even become the legal minimum standard if it doesn't come into force. We agree that the United States should take the leadership in protecting the environment from pollution by oil. The Coast Guard feels that ratification of the 1973 Marine Pollution Convention, action to implement it nationally, and encouragement of other nations to ratify it, are the best ways to demonstrate such leadership at this point in time.

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES
TRENTON NEW JERSEY 08625

SEP 2 3 1974

Captain S.A. Wallace, Chief Marine
Environmental Protection Division
U.S. Coast Guard (G-WEP/73)
Washington, D.C. 20590

Re: Proposed Regulations to Implement
Port and Water Safety Act of 1972,
(P.L. 92-340), Title II, as amended:
Oil Tanker Design and Construction Standards

Gentlemen:

Our department has reviewed with interest the proposed regulations for oil tanker design and construction standards. We do not agree with some of the reasoning behind the proposed standards. Your environmental impact statement said that more stringent requirements than the 1973 IMO agreement would "certainly be construed by foreign observers as a portent of future evidence of intent of U.S. Government not to abide by the provisions of the conference agreement. Ultimately this would encourage other nations to establish unilateral requirements, to the detriment of a coordinated international approach".

It seems to us that the more stringent regulations as originally proposed by your organization back in January 1973 would not detrimentally effect our position amongst the other nations. A requirement to protect the waters of the United States should be judged on the basis of the needs of this country and not on the economics and environmental concerns of other nations. This country requires and needs more stringent legislation and regulations because of our greater industrialization.

We also feel that traffic controls as proposed by the Coast Guard, while an important supplement to vessel features designed to prevent accidental pollution, cannot

be considered as a subsitute for such features. The use of double hull vessels and segregated ballist systems would significantly decrease pollution originating from U.S. vessels in U.S. waters.

We thank you for this opportunity to comment on your proposed regulations.

Very truly yours,

Rocco D. Ricci

Rocco D. Ricci
Assistant Commissioner

Response to State of New Jersey Department of Environmental Protection

Comments in letter dated September 23, 1974

Comment

It seems to us that the more stringent regulations originally proposed in January 1973 would not detrimentally affect our position amongst other nations. (This refers to the Advance Notice of Proposed Rulemaking in January 1973 announcing the Coast Guard as considering requiring double bottoms. See page 2 of the environmental impact statement.) A requirement to protect the waters of the United States should be judged on the basis of the needs of this country and not on the economics and environmental concerns of other nations. This country requires and needs more stringent legislation and regulations because of our greater industrialization.

Response

The Coast Guard believes U. S. coasts and waters will not be adequately protected from oil pollution from tank vessels in future years unless international agreement on methods of limiting oil inputs can be reached. The condition of this country's coasts and waters is directly linked to the condition of the rest of the world's oceans. The need for an international approach to the control of oil inputs from tankers is confirmed by the National Academy of Sciences report Petroleum in the Marine Environment. (See their conclusions at page 237 of this EIS.)

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APPENDIX A: Proposed Rules "Tank Vessels in the Domestic Trade"
Published in the June 28, 1974, Federal Register

NOTE that these are the rules proposed June 28, 1974, which are included here for reference purposes. The final rules will include the following major changes:

"New vessel" will be defined as on page 12 of the final impact statement.

Segregated ballast (required on vessels over 70,000 DWT) must be distributed to meet requirements discussed on page 19 and Appendix C to the impact statement.

DEPARTMENT OF TRANSPORTATION

Coast Guard

[33 CFR Parts 151, 157]

[CGD 74-32]

TANK VESSELS ENGAGED IN DOMESTIC TRADE

Protection of Marine Environment; Notice of Proposed Rulemaking

In consideration of the foregoing, it is proposed to amend chapter 1 of title 33, Code of Federal Regulations, as follows:

1. Section 151.35 (c) and (d) (2) would be revised to read as follows:

§ 151.35 Oil Record Book.

* * * * *

(c) If an operation listed in this paragraph occurs, the Oil Record Book must be completed in accordance with the requirements contained in paragraph (e) of this section.

(1) The following operation on a tanker must be recorded on a tank-to-tank basis:

(i) Loading of oil cargo.

(ii) Internal transfer of oil cargo during a voyage.

(iii) Opening or closing before and after loading and unloading operations of valves or similar devices that interconnect cargo tanks.

(iv) Opening or closing of means of communication between cargo piping and seawater ballast piping.

(v) Opening or closing of vessel's cargo piping valves before, during, and after loading and unloading operations.

(vi) Unloading of oil cargo.

(vii) Ballasting of cargo tanks.

(viii) Cleaning of cargo tanks.

(ix) Discharge of ballast except from segregated ballast tanks.

(x) Discharge of water from slop tanks.

(xi) Disposal of residues.

(xii) Discharge [illegible] in port or at sea of bilge water accumulated in machinery spaces.

(2) The following operations on a ship other than a tanker must be recorded on a tank-to-tank basis:

(i) Ballasting, or cleaning during voyage, of bunker fuel tanks.

(ii) Disposal of oily residues from bunker fuel tanks or other sources.

(d) * * *

(2) The escape of oil or an oily mixture resulting from—

(i) Damage to the ship;

(ii) Unavoidable leakage; or

(iii) Any accident or other exceptional circumstance.

* * * * *

2. Subchapter O would be amended by adding Part 157 to read as follows:

PART 157—INTERIM RULES AND REGULATIONS FOR PROTECTION OF THE MARINE ENVIRONMENT RELATING TO TANK VESSELS ENGAGED IN DOMESTIC TRADE

Subpart A—General

Subpart B—Design Requirements

AUTHORITY: R.S. 4417a (3) and (7), as amended (46 U.S.C. 391a (3) and (7)); 49 CFR 1.46 (o) (4).

Subpart A—General

§ 157.01 Purpose.

The regulations in this part apply to United States tank vessels engaged in the carriage of oil in domestic trade.

§ 157.03 Definitions.

As used in this part:

(a) "Length" or "L" means the distance in meters from the fore side of the stem to the axis of the rudder stock on a waterline at 85 percent of the least molded depth measured from the molded baseline, or 96 percent of the total length on that waterline, whichever is greater. In vessels designed with drag, the waterline is measured parallel to the designed waterline.

(b) "Amidships" means the middle of the length.

(c) "Breadth" or "B" means the maximum molded breadth of a vessel in meters.

(d) "Center tank" means any tank inboard of a longitudinal bulkhead.

(e) "Clean ballast" means the ballast in a tank which, if discharged from a vessel that is stationary into clean, calm water on a clear day, would not—

(1) Produce bisible traces of oil on the surface of the water or on adjoining shore lines; or

(2) Cause a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shore lines.

(f) "Combination carrier" means a vessel designed to carry oil or solid cargoes in bulk.

(g) "Deadweight" or "DWT" means the difference in metric tons between the lightweight displacement and the total displacement of a vessel measured in water of specific gravity 1.025 at the minimum permissible summer freeboard in accordance with the International Convention on Load Lines, 1966, April 5, 1966, 18 UST 1857, TIAS 6331, 640 UNTS 133.

(h) "Lightweight" means the displacement of a vessel in metric tons without cargo, oil fuel, lubricating oil, ballast water, fresh water and feedwater in tanks, consumable stores, and any persons and their effects.

(i) "New vessel" means a vessel that—

(1) Is constructed under a contract awarded after December 31, 1974;

(2) In the absence of a building contract, has the keel laid or is at a similar stage of construction after June 30, 1975;

(3) Is delivered after December 31, 1977; or

(4) Has undergone a major conversion for which—

(i) The contract is awarded after December 31, 1974;

(ii) In the absence of a contract, conversion is begun after June 30, 1975; or

(iii) Conversion is completed after December 31, 1977.

(j) "Existing vessel" means any vessel that is not a new vessel.

(k) "Major conversion" means a conversion of an existing vessel that—

(1) Substantially alters the dimensions or carrying capacity of the vessel;

(2) Changes the type of the vessel;

(3) The intent of which, in the opinion of the Coast Guard, is substantially to prolong the vessel's service life; or

(4) Otherwise so alters the vessel or a portion of the vessel that the vessel is no longer considered by the Coast Guard to be an existing vessel.

(l) "From the nearest land" means from the baseline from which the territorial sea of the United States is established in accordance with international law.

(m) "Instantaneous rate of discharge of oil content" means the rate of discharge of oil in liters per hour at any instant, divided by the speed of the vessel in knots at the same instant.

(n) "Oil" means petroleum in any form including oil, sludge, oil refuse, and refined products.

(o) "Oil fuel" means any oil used as fuel for the propulsion and auxiliary machinery of the vessel in which it is carried.

(p) "Oily mixture" means a mixture with any oil content.

(q) "Permeability of a space" means the ratio of the volume within a space that is assumed to be occupied by water to the total volume of that space.

(r) "Segregated ballast" means the ballast water that is introduced into a tank which is completely separated from the cargo oil and oil fuel system and which is permanently allocated to the carriage of ballast.

(s) "Slop tank" means a tank specifically designated for the collection of cargo drainings, washings, and other oil mixtures.

(t) "Tank" means an enclosed space that is formed by the permanent structure of a vessel, and designed for the carriage of liquid in bulk.

(u) "Tank barge" means a tank vessel not equipped with a means of self-propulsion.

(v) "Tank vessel" means a vessel that is specially constructed or converted to carry liquid bulk cargo in tanks and includes tankers, tankships, tank barges, and combination carriers when carrying oil cargoes in bulk.

(w) "U.S. vessel" means a vessel that is owned, documented, or registered in the United States and is not a public vessel.

(x) "Wing tank" means a tank that is located adjacent to the side shell plating.

(y) "Tankship" means a tank vessel propelled by mechanical power or sail.

(z) "Domestic trade" means trade between ports or places within the United States, its territories and possessions, either directly or via a foreign port including trade on the navigable rivers, lakes, and inland waters.

§ 157.05 Rules of procedure and construction.

In this part, unless the context requires otherwise—

(a) Metric system units must be used in performing calculations and measurements;

(b) Volumes and areas must be calculated using molded line dimensions of the vessel; and

(c) Forward and after perpendiculars are located at the forward and after ends of the lengths, respectively. The forward perpendicular coincides with the foreside of the stem on the waterline on which the length of the vessel is measured.

§ 157.07 Equivalents.

The Coast Guard may accept an equivalent, in accordance with the procedure in 46 CFR 30.15-1, of a design or an equipment to fulfill a requirement in this part except an operational method may not be substituted for a design or equipment requirement.

Subpart B—Design Requirements

§ 157.08 Applicability.

(a) The requirements in this subpart apply to seagoing tank vessels of 150 gross tons or more, unless otherwise specified, except the requirements of §§ 157.11, 157.13, and 157.15 do not apply to a vessel that engages exclusively in the carriage of asphalt.

(b) The requirements in § 157.21 also apply to vessels engaged in the carriage of oil on the navigable waters of the Great Lakes.

§ 157.09 Segregated ballast tanks.

(a) A new vessel of 70,000 tons deadweight or more must be designed with segregated ballast tanks that comply with the requirements of this section.

(b) The combined capacity of the segregated ballast tanks must be of sufficient size so that the vessel can operate safely on ballast voyages without recourse to the use of oil tanks for water ballast.

(c) In any ballast condition during any part of a voyage, including the conditions consisting of lightweight and segregated ballast, the vessel's drafts and trim must meet each of the following requirements:

(1) The molded draft amidship (dm) in meters without taking into account vessel deformation must not be less than dm in the following mathematical relationship:

$$dm = 2.0 + 0.02L$$

(2) The drafts at the forward and after perpendiculars must correspond to those determined by the draft amidship as specified in paragraph (c)(1) of this section, in association with the trim by the stern of no more than 0.015L.

(3) The minimum allowable draft at the after perpendicular is that which is necessary to obtain full immersion of the propeller.

(d) The vessel may be designed to carry ballast water in a cargo tank during the condition described in § 157.35.

§ 157.11 Pumping, piping, and discharge arrangements.

(a) If a vessel's operation includes discharging into the sea effluent that is in compliance with subpart C of this part, a pipeline that terminates on a weather deck or on the vessel's side above the waterline in the deepest ballast condition must be installed except—

(1) An additional piping arrangement may be used for the discharge of segregated ballast and clean ballast below the waterline while the vessel is in a port or at an offshore terminal; and

(2) An existing vessel is not required to alter piping to discharge segregated ballast above the waterline in the deepest ballast condition.

(b) A vessel must have a fixed piping system designed to allow the transfer of dirty ballast residue and tank washings from a cargo tank into a slop tank.

(c) Except as allowed in § 155.370(b)(2) of this chapter, a vessel must have a manifold that is located on the weather deck and that terminates on each side of the vessel for connection to a reception facility to transfer dirty ballast water or an oily mixture.

§ 157.13 Designated area.

A new vessel must have a designated observation area on the weather deck or above that is—

(a) Located so that the effluent from the pipeline terminations required in § 157.11(a) and the discharge manifold required in § 157.11(c) may be visually observed; and

(b) Equipped with—

(1) A means to directly stop the discharge of effluent into the sea; or

(2) A positive communication system, such as a telephone or a radio, between the observation area and the discharge control position.

§ 157.15 Slop tanks in vessels.

(a) *Number.* A vessel must have the following minimum number of slop tanks that comply with the requirements of this section:

(1) A new vessel of less than 70,000 tons DWT and an existing tank vessel must have one slop tank.

(2) A new tank vessel of 70,000 tons DWT or more must have two slop tanks.

(b) *Capacity.* Slop tanks must have the capacity to retain slop from tank washings, oil residues, and dirty ballast residues but the total capacity may not be less than three percent of the oil carrying capacity except two percent capacity may be allowed if—

(1) There are segregated ballast tanks that meet the requirements contained in § 157.09; or

(2) There are no eductors fitted that use water in addition to the washing water.

(c) *Design.* A slop tank must be designed to minimize turbulence, entrainment of oil, and the creation of an emulsion in the tank by the use of separate inlet and outlet connections, and if baffles, weirs, or similar separation aids are used, they must aid in the oil/water separation process.

NOTE: An existing vessel must comply with the requirements in § 157.15 before December 31, 1977.

§ 157.17 Oily residue tank.

(a) A vessel of 400 gross tons or more must have a tank that receives and holds oily residue resulting from purification of fuel and lubricating oil and from oil leakages in machinery spaces.

(b) Each oily residue tank required in paragraph (a) of this section must have an adequate capacity that is determined by the—

(1) Type of machinery installed on the vessel; and

(2) Maximum fuel oil capacity.

(c) Each oily residue tank on a new vessel must be designed to facilitate—

(1) Cleaning; and

(2) Discharging to a reception facility.

NOTE: An existing vessel must comply with the requirements in § 157.17 (a) and (b) before December 31, 1977.

§ 157.19 Cargo tank arrangement and size.

(a) The requirements in this section apply to—

(1) A new vessel;

(2) A vessel delivered after January 1, 1977; and

(3) A vessel that is delivered before January 1, 1977 for which the building contract is awarded after January 1, 1972, or, if there is no building contract, the keel is laid or the vessel is at a similar stage of construction after June 30, 1972.

(b) As determined in accordance with the procedures contained in Appendix A of this part, each cargo tank must be of such size and arrangement that—

(1) The hypothetical outflow for side damage (O_c) or for bottom damage (O_s) anywhere within the length of the vessel must not exceed O_A (30,000 cubic meters or $400\sqrt[3]{DWT}$, whichever is greater, limited to a maximum of 40,000 cubic meters);

(2) The volume of each wing cargo tank and center cargo tank is less than the allowable volume of a wing cargo tank (VOL_w) and the allowable volume of a center cargo tank (VOL_c) respectively; and

(3) The length of a cargo tank is less than the allowable length of a cargo tank (l_t).

(c) If a cargo transfer system interconnects two or more cargo tanks, the system must have valves to segregate the tanks from each other.

(d) A line of piping that runs through a cargo tank in a position less than t_c from the vessel's side or less than v_s from the vessel's bottom, as defined in Appendix A of this part, must be fitted with a valve at the point the piping opens into a cargo tank.

(e) If piping that serves suction wells is installed within a double bottom, the piping must be—

(1) Fitted with valves located at the point of connection to the tank served to prevent oil outflow in the event of damage to the piping; and

(2) Designed to be installed as high from the bottom shell as possible.

(f) Calculations of the tank arrangement and size requirement contained in paragraph (b) of this section must be submitted for Coast Guard review with the plans and specifications that are required in 46 CFR 31.10–5.

NOTE.—Vessels within the categories in § 157.19(a)(3) must meet the requirements in § 157.19 before December 31, 1976. If a vessel is constructed under a contract that was awarded before January 1, 1974 and does not carry crude oil, fuel oil, heavy diesel oil, or lubricating oil, the requirements in § 157.19 do not apply.

§ 157.21 Subdivision and stability.

(a) A new vessel must meet the following subdivision and damage stability criteria after assuming side and bottom damage as defined in Appendix B of this part:

(1) The final waterline, taking into account sinkage, heel, and trim, must be below the lower edge of an opening through which progressive flooding may take place, such as an air pipe, or an opening that is closed by means of a weathertight door or hatch cover. This opening does not include those closed by a—

(i) Watertight manhole cover;

(ii) Flush scuttle;

(iii) Small watertight cargo tank hatch cover that maintains the high integrity of the deck;

(iv) Remotely operated watertight sliding door; or

(v) Side scuttle of the non-opening type.

(2) In the final stage of flooding, the angle of heel due to unsymmetrical flooding must not exceed 25 degrees, except that this angle may be increased to 30 degrees if no deck edge immersion occurs.

(3) For acceptable stability in the final stage of flooding, the righting lever curve must have a range of at least 20 degrees beyond the position of equilibrium in association with a maximum residual righting lever of at least 0.1 meter. Protected or unprotected openings that may become temporarily immersed within the range of residual stability must be accounted for in the calculation.

(4) The stability must be sufficient during intermediate stages of flooding.

(b) Calculations to substantiate compliance with subdivision and damage stability criteria contained in paragraph (a) of this section must be submitted for Coast Guard review with the plans and specifications required in 46 CFR 31.10–5 and must include—

(1) The design characteristics of the vessel, the arrangements, configuration and contents of the damaged compartments; and

(2) The distribution, specific gravities, and the free surface effect of liquids.

§ 157.23 Cargo and ballast system information.

(a) A vessel designed in accordance with the requirements of this part must have an instruction manual that describes the automatic and manual operation of the cargo and ballast system in the vessel and that is approved by the Coast Guard with the plans and specifications required in 46 CFR 31.10–5.

(b) The style and format of the instruction manual required in paragraph (a) of this section must be similar to the manual entitled "Clean Seas Guide for Oil Tankers" which can be obtained from the International Chamber of Shipping, 30–32 St. Mary Axe, London, England, EC3A 8ET.

Subpart C—Vessel Operation

§ 157.25 Applicability.

This subpart prescribes regulations for the discharging of clean ballast, segregated ballast, and oily mixtures from, and for the carriage of ballast water on—

(a) Vessels engaged in the carriage of oil exclusively on rivers, lakes, bays, sounds and the Great Lakes; and

(b) Seagoing vessels.

§ 157.27 Discharges; vessels engaged in the carriage of oil exclusively on rivers, lakes, bays, sounds, and the Great Lakes, and seagoing vessels of less than 150 gross tons.

Unless a vessel engaged in the carriage of oil exclusively on rivers, lakes, bays, sounds, and the Great Lakes, or a seagoing vessel of less than 150 gross tons discharges clean ballast or segregated ballast, the vessel must—

(a) Retain on board an oily mixture; or

(b) Transfer an oily mixture to a reception facility.

§ 157.29 Discharges; seagoing vessels of 150 gross tons or more.

Unless a seagoing vessel of 150 gross tons or more discharges an oily mixture in compliance with the requirements in §§ 157.37, 157.39, or 157.43, the vessel must—

(a) Retain the mixture; and

(b) Transfer the mixture to a reception facility.

§ 157.31 Discharges; chemical additives.

No person may use a chemical additive to circumvent the discharge requirements in §§ 157.27, 157.29, 157.37, 157.39, and 157.43.

§ 157.33 Water ballast in oil fuel tanks.

A new vessel may not carry ballast water in an oil fuel tank.

§ 157.35 Ballast added to cargo tank.

A vessel that meets the design requirement in § 157.09(c) may carry water ballast in a cargo tank during abnormally severe weather conditions if more ballast water than can be carried in segregated ballast tanks is required for the safety of the vessel. This ballast water must be—

(a) Processed and discharged in compliance with the requirements in § 157.37; and

(b) Recorded in the Oil Record Book in accordance with the requirements in § 151.35(c)(1)(vii) of this chapter.

§ 157.37 Discharge of cargo residue.

(a) Except as required in paragraph (b) of this section, the discharge into sea of an oily mixture from a cargo tank and cargo pump room bilges of a vessel is prohibited unless the vessel—

(1) Is more than 50 nautical miles from the nearest land;

(2) Is proceeding en route;

(3) Is discharging at an instantaneous rate of oil content not exceeding 60 liters per nautical mile;

(4) Is an existing vessel and the total quantity of oil discharge into the sea does not exceed 1/15,000 of the total quantity of the cargo that the discharge formed a part, or is a new vessel and the total quantity of oil discharged into the sea does not exceed 1/30,000 of the total quantity of the cargo that the discharge formed a part; and

(5) Has in operation an oil discharge monitoring and control system approved by the Coast Guard (specification regulation to be proposed).

(b) A vessel that engages exclusively in the carriage of asphalt must transfer cargo residues and tank washings to a reception facility.

§ 157.39 Machinery spaces bilges.

(a) No vessel may discharge an oily mixture from a machinery space bilge that is combined with an oil cargo mixture unless the vessel discharges in compliance with § 157.37.

(b) A vessel may discharge an oily mixture from a machinery space bilge that is not within the prohibition contained in paragraph (a) of this section if the vessel—

(1) Is more than 12 nautical miles from the nearest land;

(2) Is proceeding en route;

(3) Is discharging an effluent with an oil content of less than 100 parts per million; and

(4) Has in operation an oil discharge monitoring and control system approved by the Coast Guard (specification regulation to be proposed) and an oily water separating equipment approved by the Coast Guard (specification regulation to be proposed).

§ 157.41 Emergencies.

Sections 157.27, 157.29, 157.37, and 157.39 do not apply to a vessel that discharges into the sea oil or oily mixtures—

(a) For the purpose of securing the safety of the vessel or for saving life at sea; or

(b) As a result of damage to the vessel or its equipment if—

(1) Reasonable precautions are taken after the occurrence of the damage or discovery of the discharge for the purpose of preventing or minimizing the discharge; and

(2) The owner, master or person in charge did not intend to cause damage, or did not act recklessly and with knowledge that damage of the environment would probably result.

§ 157.43 Discharge in ports or at offshore terminal.

A master may discharge in a port or at an offshore terminal segregated ballast and clean ballast through the piping described in § 157.11(a) if he makes a visual examination of the top of the contents of the tank to be discharged and finds there is no oily mixture in the contents.

§ 157.45 Valves in cargo or ballast piping system.

If a vessel is at sea and the tanks contain oil, each valve or closing device in the cargo or ballast piping system or in the transfer system must be kept closed except they may be opened for cargo transfer to trim the vessel.

§ 157.47 Information for master.

A master or person in charge shall operate the vessel in accordance with the—

(a) Stability information required in 46 CFR 31.01–30(d);

(b) Damage stability information determined in accordance with the criteria contained in Appendix B of this part; and

(c) Loading and distribution of cargo information determined in compliance with the damage stability criteria required in Appendix B of this part.

§ 157.49 Instruction manual.

No person may operate the cargo and ballast systems unless he operates in compliance with the approved instruction manual required in § 157.23.

APPENDIX A—DAMAGE ASSUMPTIONS, HYPOTHETICAL OUTFLOWS, AND CARGO TANK SIZE AND ARRANGEMENTS

1. *Source.* The procedures for the damage assumption calculations contained in this Appendix conform to Regulations 22, 23, and 24 of Annex I of the International Convention for the Prevention of the Pollution from Ships, 1973 done at London, November 2, 1973.

2. *Assumptions.* For the purpose of calculating hypothetical outflow from tank vessels, three dimensions of the extent of damage of a parallelepiped on the side and bottom of the vessel are assumed.

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(a) For side damage, the conditions are as follows:

Damage:	*Conditions*
(1) Longitudinal extent (l_c):	$\frac{1L^{2/3}}{3}$ or 14.5 meters, whichever is less.
(2) Transverse extent (t_c): (inboard from the vessel's side at angles to the centerline at the level corresponding to the assigned summer freeboard).	$\frac{B}{5}$ or 11.5 meters whichever is less.
(3) Vertical extent (v_c):	From the base line upwards without limit.

(b) For bottom damage, two conditions to be applied individually to the stated portions of the vessel, as follows:

Damage	Conditions	
	For 0.3L from the forward perpendicular of ship	Any other part of ship
(1) Longitudinal extend (l_s).	$\frac{L}{10}$	$\frac{L}{10}$ or 5 meters, whichever is less.
(2) Transverse extent (t_s).	$\frac{B}{6}$ or 10 meters, whichever is less but not less than 5 meters.	5 meters.
(3) Vertical extent from the base line (v_s).	$\frac{B}{15}$ or 6 meters, whichever is less.	$\frac{B}{15}$ or 6 meters, whichever is less.

3. *Hypothetical Outflow of Oil.* (a) The hypothetical outflow of oil in the case of side damage (O_c) and bottom damage (O_s) is calcalculated by the following formula with respect to compartments breached by damage to all conceivable locations along the length of the vessel to the extent as defined in section 2 of this Appendix.

(1) For side damages: Formula (I)

$$O_c = \Sigma W_i + \Sigma K_i C_i$$

(2) For bottom damage: Formula (II)

$$O_s = \frac{1}{3}(\Sigma Z_i W_i + \Sigma Z_i C_i)$$

Where:

W_i = Volume of a wing tank assumed to be breached by the damage as specified in section 2 of this Appendix; W_i for a segregated ballast tank may be taken equal to zero,

C_i = Volume of a center tank assumed to be breached by the damage as specified in section 2 of this Appendix C_i for a segregated ballast tank may be taken equal to zero,

$K_i = 1 - \frac{b_i}{T_c}$: when b_i is equal to or greater than t_c, K_i is equal to zero,

$Z_i = 1 - \frac{h_i}{v_s}$: when h_i is equal to or greater than v_s, Z_i is equal to zero,

b_i = Minimum width of wing tank under consideration measured inboard from the vessel's side at right angles to the centerline at the level corresponding to the assigned summer freeboard.

h_i = Minimum depth of the double bottom under consideration; where no double bottom is fitted, h_i is equal to zero.

(b) If a void space or segregated ballast tank of a length less than l_c is located between wing oil tanks, O_c in formula (I) of this section may calculated on the basis of volume W_i being the actual volume of one such tank (where they are of equal capacity) or the smaller of the two tanks (if they differ in capacity), adjacent to such space, multiplied by S_i as defined below and taking for all other wing tanks involved in such a collision the value of the actual full volume.

$$S_i = 1 \frac{-l_i}{l_c}$$

Where l_i = length of void space or segregated ballast tank under consideration.

(c) Credit may only be given in respect of double bottom tanks which are either empty or carrying clean water when cargo is carried in the tanks above.

(1) If the double bottom does not extend for the full length and width of the tank involved, the double bottom is considered nonexistent and the volume of the tanks above the area of the bottom damage must be included in formula (II) of this section even if the tank is not considered breached because of the installation of such a partial double bottom.

(2) Suction wells may be neglected in the determination of the value h_i if such wells are not excessive in area and extend below the tank for a minimum distance and in no case more than half the height of the double bottom. If the depth of such a well exceeds half the heights of the double bottom h_i taken equal to the double bottom height minus the well height.

(d) In the case where bottom damage simultaneously involves four center tanks, the value of O_s may be calculated according to formula (III) as follows:

$$O_s = 1/4(\Sigma Z_i W_i + \Sigma Z_i C_i)$$

4. *Allowable volumes of cargo tanks.* (a) The allowable volume of a wing cargo tank (VOL_w) is equal to seventy-five percent of O_A. In a segregated ballast tank vessel VOL_w may equal O_A for a wing cargo oil tank located between two segregated ballast tanks each of lentgh greater than l_c and width greater than t_c.

(b) The allowable volume of a center cargo tank (VOL_c) is 50,000 cubic meters.

5. *Allowable length of cargo tanks.* The allowable length of a cargo tank (l_s) is equal to the greater of 10 meters or one of the following values:

(a) If no longitudinal bulkhead is provided, 0.1L

(b) If a longitudinal bulkhead is provided at the centerline only, 0.15L

(c) If two or more longitudinal bulkheads are provided:

For wing tanks, 0.2L; and

center tanks—

(i) If $\frac{b_i}{B}$ is equal to or greater than $\frac{1}{5}$, 0.2L; or

(ii) If $\frac{b_i}{B}$ is less than $\frac{1}{5}$ and—

(A) No centerline longitudinal bulkhead is provided, $(0.5 \frac{b_i}{B} + 0.1)$ L, or

(B) A centerline longitudinal bulkhead is provided, $(0.25 \frac{b_i}{B} + 0.15)$ L.

APPENDIX B—SUBDIVISION AND STABILITY ASSUMPTIONS

1. *Source.* The procedures for the loading assumption calculations contained in this Appendix conform to Regulation 25 of Annex I of the International Convention for the Prevention of the Pollution from Ships, 1973, done at London, November 2, 1973.

2. *Loading Assumptions.* For the purpose of calculating subdivision and damage stability for a tank vessel, the operating drafts must reflect actual partial or full load conditions consistent with trim and strength of the vessel. Ballast conditions need not be considered if the tank vessel is not carrying oil in cargo tanks excluding oily residues. Loading condition must reflect the specific gravities of the cargo.

3. *Damage Assumptions.* (a) Damage is applied to all conceivable locations along the length of the vessel as follows:

(1) For a vessel of more than 225 meters in length, anywhere in the vessel's length.

(2) For a vessel of more than 150 meters, but not exceeding 225 meters in length, anywhere in the vessel's length except where the after or forward bulkhead bounding a machinery space located aft is involved in the damage assumption. The machinery space is calculated as a single floodable compartment.

(3) For a vessel less than 150 meters in length, anywhere in the vessel's length between adjacent transverse bulkheads except the machinery space.

(b) The extent and the character of the assumed side or bottom damage, as defined in section 2 of Appendix A of this part, must be applied except longitudinal bottom damage within 0.3L from the forward perpendicular must be assumed to be the same as that for side damage. If any damage of lesser extent results in a more severe condition, such damage must be assumed.

(c) Where damage involves transverse bulkheads as specified in paragraphs (a)(1) and (2) of this section, transverse watertight bulkheads must be spaced at least at a distance equal to the longitudinal extent of assumed damage specified in paragraph (a) (1) of this section in order to be considered effective. Where transverse bulkheads are spaced at a lesser distance, one or more of these bulkheads within such extent of damage must be assumed as nonexistent for the purpose of determining flooded compartments.

(d) If the damage between adjacent transverse watertight bulkheads is within the definition contained in paragraph (a)(3) of this section, no main transverse bulkhead or a transverse bulkhead bounding side tanks or double bottom tanks is to be assumed damaged, unless—

(1) The spacing of the adjacent bulkheads is less than the longitudinal extent of assumed damage defined in paragraph (b) of this section; or

(2) There is a step or a recess in a transverse bulkhead of more than 3.05 meters in length, located within the extent of penetrations of assumed damage. The step formed by the after peak bulkhead and after peak tank top is not regarded as a step for these calculations.

(e) If pipes, ducts, or tunnels are situated within the assumed extent of damage, there must be arrangements so that progressive flooding may not thereby extend to compartments other than those assumed to be floodable for each case of damage.

4. *Characteristic and Condition Assumptions for Calculations.* (a) Account must be taken of any empty or partially filled tanks, the specific gravity of cargoes carried, and any outflow of liquids from damaged compartments.

(b) The permeabilities are assumed as follows:

Intended Space Use:	*Permeability*
Stores	0.60
Accommodation	0.95
Machinery	0.85
Voids	0.95
Consumable liquids	[1] 0 or 0.95
Other liquids	[2] 0 or 0.95

[1] Whichever results in the more severe requirements.

[2] The permeability of partially filled compartments must be consistent with actual density and the amount of liquid carried.

(c) The buoyance of any superstructure directly above the side damage is to be disregarded. The unflooded parts of superstructures beyond the extent of damage may be taken into consideration if they are separated from the damaged space by watertight bulkheads and no progressive flooding of these intact spaces takes place. Class I doors are allowed in watertight bulkheads in the superstructure.

(d) The free surface effect is to be calculated at an angle of 5 degrees for each individual full compartment. Partially filled tanks must have free surface corrections computed at final angle of heel.

(e) In calculating the effect of free surfaces of consumable liquids, it is to be assumed that, for each type of liquid, at least one transverse pair or a single centerline tank has a free surface and the tank or combination of tanks to be taken into account is to be those where the effect of free surface is the greatest.

(R.S. 4417a(3) and (7), as amended (46 U.S.C. 391a(3) and (7)); 49 CFR 1.46(o)(4)).

Dated: June 25, 1974.

W. M. BENKERT,
Rear Admiral, U.S. Coast Guard, Chief, Office of Merchant Marine Safety.

[FR Doc.74-14884 Filed 6-27-74;8:45 am]

APPENDIX B: Conclusions of a study by the Ocean Affairs Board of the National Academy of Sciences entitled <u>Petroleum in the Marine Environment</u>, pages 104 - 107

5 Conclusions

The quantity of petroleum hydrocarbons entering the ocean today has been variously estimated to range from 5 to 10 million metric tons per annum (mta). Our judgment, as shown in Table 5-1, is in the lower part of this range.

The first four estimates in Table 5-1 are based on data that can be at least partially documented. The last two estimates contain major uncertainties and untested assumptions.

The river runoff input was estimated from an unpublished value of 400 ppm petroleum hydrocarbons measured in sediments deposited in the mouth of the Mississippi River and supported by analyses of other rivers of the world. However, direct measurements of petroleum hydrocarbons dissolved and dispersed in river waters as well as those carried on the water surface and by suspended particles are still very limited.

TABLE 5-1 Petroleum Hydrocarbons in the Ocean

Input	Million Metric Tons per Annum
Transportation	2.133
Tankers, dry docking, terminal operation, bilges, accidents	
Coastal refineries, municipal and industrial waste	0.8
Offshore oil productions	0.08
River and urban runoff	1.9
Atmospheric fallout	0.6
Natural seeps	0.6
TOTAL	6.113

Petroleum hydrocarbon inputs from the atmosphere depend on the reaction kinetics of various compounds entering the atmosphere as well as the nature and fate of the volatile and particulate reaction products. Because very little of this information exists, our estimate was made from the known influx of petroleum hydrocarbons and our general knowledge of atmosphere residence times in global precipitation patterns.

The natural seeps input was estimated from a major extrapolation from a few known seeps. This involved estimating seeps from many areas where seeps have never been identified. No satisfactory method is available for measuring seepage rates, and our current inventory of seep areas is incomplete.

The best estimate in the table is for the input associated with transportation. It can be documented from data on tankers, terminal, and ship operations. This input represents the major source of visible accumulation of petroleum hydrocarbons both on open oceans and along coast lines.

The quantity of oil entering the oceans from transportation-related sources has been increasing every year; given future increases in production and transport, it is possible that transportation-related inputs will continue to increase despite the current interest and activity in control measures. Although the United States and a few other oil-carrying countries are adopting improved measures, such measures (e.g., Load On Top) have not been accepted as common practice by all of the major oil transporters. The capability of achieving a marked

reduction in the input of oil to the sea exists, but it is heavily dependent on a much wider adoption of known control measures by all countries. The immediate need is to improve the international operation, control, and surveillance of tanker and shipping operations to minimize oil spills. Emphasis should be directed toward achieving maximum Load On Top operation by all ocean-going tankers as well as the increased use of segregated ballast tankers.

Reducing inputs to coastal waters by coastal refineries, river runoff, etc., is a much more difficult problem. Progress here will require improved control of petroleum hydrocarbon sources in municipal and industrial waste water. The control of automobile emission may reduce atmospheric fallout.

There is a need for accurate, standardized techniques for chemical analysis and for biological studies so that a more reliable analysis can be made of the ultimate fate of and biological effects of petroleum hydrocarbons. Meeting this need is very difficult due to the exceedingly complex and varied nature of petroleum as well as the wide variety of biological species and environmental conditions involved.

Conflicting reports of the biological damage following coastal oil spills can be attributed in some instances to differences in sampling procedures and analytical techniques, rather than to different environmental factors. In other instances, reports of damage to biota have not been placed in the context of normal fluctuation of the biota caused by natural environmental changes. The design of laboratory experiments to evaluate biological impairment must be such as to provide reliable data without being excessively complicated or expensive.

It is particularly important that known techniques for distinguishing between petroleum and biogenic hydrocarbons be used to determine the petroleum concentration in sediments, organisms, and water. Natural hydrocarbons are widespread so that data on total hydrocarbon content are of little value without some criteria for differentiating the petroleum hydrocarbons from the natural hydrocarbons. Unfortunately, even with present techniques this distinction cannot be made for some types of sediments and the ability to distinguish petroleum from natural hydrocarbons is less reliable at low concentrations. A reliable estimate of total hydrocarbons now in the open ocean is not possible until more sensitive diagnostic methods for determining the quantities of hydrocarbons from petroleum and biogenic sources become available.

When petroleum is spilled into the ocean, it immediately begins to undergo changes through evaporation, solution, spreading, emulsification, air–sea interchange, biological degradation and uptake, and sedimentation. The composition of petroleum and characteristics of the environment—such as temperature, concentration of bacteria and nutrients, and sea state—determine the rate at which petroleum is altered. Because the fate of diffused sources is largely unknown, it is not possible to make a material balance of the input and ultimate fate of petroleum hydrocarbons in the oceans. The fate of point sources is only partially known, namely by the accumulation of lumps, tar balls, and large mats of tarry oil residues on the open ocean and beaches along tanker routes.

The fate of most petroleum spills on the sea appears to be a combination of evaporation and decomposition in the atmosphere plus oxidation by chemical and biological means to CO_2. The heavier fraction of petroleum forms pelagic tar. The total amount of petroleum on the open sea in the form of specks and floating lumps is estimated to be less than a year's input. Some fraction of this amount eventually becomes washed up on beaches and incorporated into coastal sediments. It is this portion of spilled oil that causes most public complaints. Tar masses are appearing in increased quantity in formerly unpolluted areas such as the East Coast of Africa, the beaches of Southern France, and many islands in both the Indian and Atlantic oceans. Recent reports clearly document the quantity and nature of these tar residues in areas such as Bermuda. The fact that these tars frequently have inclusions of paraffinic wax such as that originally formed on tanker compartment walls and that they have much higher iron contents than natural petroleum is evidence that most of these materials originate from tanker washings and bilge discharges, rather than diffused sources of petroleum input or seeps.

The documentation of visible tar on beaches only accounts for a fraction of the total input into the ocean. To construct a reliable model of the fate of petroleum in the marine environment surveys over large portions of the world's oceans combined with time series data at several individual stations are needed. Data on the rate of sedimentation of petroleum residues in both open ocean and coastal areas and its incorporation into marsh and tidal flat sediments where it has considerable ecological impact are particularly important.

When oil becomes incorporated in coastal sands protected from the weathering effects of sun and oxygen, its residence time may be measured in years or decades. Unless steps are taken to reduce the input to a level that can be assimilated through natural degradation processes, we will all have to reconcile ourselves to oil-contaminated beaches.

Microorganisms capable of oxidizing petroleum constituents under the right conditions have been found in virtually all parts of the marine environment that have been examined. However, reliable information on the

rates of biodegradation are not available. Both laboratory experiments and some field observations have shown that microorganisms consume the least toxic fraction of petroleum (normal alkanes) in a few days or months, depending on temperature and nutrient supply. The fraction containing aromatics and naphthenes is more toxic than the alkanes and also degrades more slowly.

Larger organisms take up hydrocarbons through the gills or from fluid passing through the gut. The quantity of petroleum hydrocarbons (excluding biogenic hydrocarbons) in the total body (wet weight) of various marine organisms reported in the literature ranges from 1 to 400 μg/g. These include organisms from clean, as well as polluted, environments. Fish and lobsters have been shown to metabolize most petroleum hydrocarbons within 2 weeks, but metabolism in lower organisms is slower and the pathways are poorly understood. There is no evidence, however, for food web magnification of petroleum hydrocarbons in marine organisms. Direct uptake of petroleum hydrocarbons from the water or sediments appears to be more important than uptake from the food chain, except in special cases. Some organisms such as mussels and oysters have been shown to eliminate most absorbed petroleum hydrocarbons when placed in clean water.

An accurate evaluation of the fate of petroleum through microbial degradation and biological uptake cannot be made until better designed and more rigorously conducted field studies are carried out. Laboratory experiments involve so many factors not encountered in the natural environment and vice versa, that few data have been useful in defining the biological fate of petroleum in the marine environment.

The most damaging, indisputable adverse effects of petroleum are the oiling and tarring of beaches, the endangering of seabird species, and the modification of benthic communities along polluted coastlines where petroleum is heavily incorporated in the sediments. The first two of these effects occur predominantly from discharges and spills of tanker and ship operations. The toxicity and smothering effect of oil caused mortality in all major spills studied, with pelagic diving birds and intertidal to subtidal benthic organisms being most affected. Mortality was greatest where oil spills were confined to inshore areas with abundant biota. The effects were generally quite localized, ranging from a few miles to tens of miles, depending on the quantity of petroleum involved.

Different petroleum products have different effects. Toxicity is greatest for refined distillates, particularly those high in aromatic hydrocarbons. Physical smothering is most severe with heavy crude oils and Bunker C fuel oil. The effects of oil in different environments may vary considerably due to synergistic interactions between oil and other environmental stresses. A single coating of fresh or weathered crude oil will cause mortality in certain bird species and plant seeds, whereas marsh plants are killed only after several coatings.

Fish do not appear to suffer from oil spills as much as seabirds and benthic organisms. Fish may acquire an oily flavor from feeding on oil-contaminated organisms, and widespread tainting of fish flesh may persist as long as significant quantities of oil are present. A long-range hazard exists for some birds such as auks and penguins because they have such slow reproductive rates that marked increases in mortality may be causing their gradual elimination.

Although our information is limited, the effect of oil contamination on human health appears not to be cause for alarm. From our calculation, we estimate that the carcinogen benzo[a]pyrene concentration on a dry weight basis arising from a high level of contamination by petroleum is comparable with that of common terrestrial foods. We, of course, do not recommend eating contaminated seafood, but in most cases, because of the taste factor, not many will be tempted to do so. It is clear that this is an area in which our knowledge is grossly inadequate and that the contamination of seafood by oil is clearly undesirable.

There are those who strongly urge the use of detergents to disperse point sources of petroleum input, such as tanker spills. This practice was not discussed in detail by the workshop, but an obvious argument in favor of detergents is that the conversion of an oil spill into a diffused and disseminated form will minimize the quantity of oil eventually reaching the beaches. Thus, the use of detergents is one way to eliminate the most visible evidence of petroleum spills. The difficulty with this practice is that we do not know what happens to the dispersed hydrocarbons. Are they truly degraded, or do they simply spread the toxic effects of oil over a larger area? Nevertheless, the use of detergents to disperse the oil at the surface where it is exposed to the weathering effects of oxygen and surface organisms is clearly preferable to the use of oleophilic sands to sink oil spills to the sea bottom. Experiments on the latter technique in the North Sea clearly resulted in oil-tainted finfish and shellfish from the area for several weeks following the experiment.

In general, much more research regarding the fates and effects of petroleum hydrocarbons in the marine environment is needed. We know that the quantity of floating tar in the open ocean and of tar along coastlines has been increasing, that major spills and localized continuous discharges of petroleum hydrocarbons have damaged various species of marine life, and that low levels of petroleum may affect the behavior patterns

of certain species. Studies to date indicate that areas polluted with petroleum hydrocarbons "recover" within weeks or years (depending on local conditions and the characteristics of the petroleum); however, composition of the local biological communities may be altered. The oceans have considerable ability to purify themselves by biological and chemical actions. A basic question that remains unanswered is, "At what level of petroleum hydrocarbon input to the ocean might we find irreversible damage occurring?" The sea is an enormously complex system about which our knowledge is very imperfect. The ocean may be able to accommodate petroleum hydrocarbon inputs far above those occurring today. On the other hand, the damage level may be within an order of magnitude of present inputs to the sea. Until we can come closer to answering this basic question, it seems wisest to continue our efforts in the international control of inputs and to push forward research to reduce our current level of uncertainty.

APPENDIX C: Report of Study Group on Location of Segregated Ballast

SEGREGATED BALLAST TANKER STUDY

SHIP CONFIGURATION

Study Group Report

April 28, 1975

SEGREGATED BALLAST TANKER STUDY - SHIP CONFIGURATION

I N D E X

INDEX
(Continued)

Appendix C-Draft 157.09(e) Segregated ballast spaces must be distributed between the cargo tanks and the outer hull or between cargo wing tanks so as to satisfy the criteria of the Appendix C to the regulations in Part 157.

SEGREGATED BALLAST TANKER STUDY - SHIP CONFIGURATION

Abstract

At the request of the United States Coast Guard a study group of knowledgeable operating and technical professionals has reviewed the issue of how best to utilize segregated ballast capacity as specified in the 1973 IMCO Pollution Prevention Convention for new building tankers larger than 70,000 dwt. Specifically, the study group wished to determine if there were preferable positions for placement of segregated ballast tanks which might serve as a defensive mechanism to mitigate or prevent accidental pollution and provide some measure of protection from other types of ship accidents.

To answer these questions the group investigated twelve possible concepts for the location of segregated ballast particularly in relation to ships of the 120 to 250,000 dwt size with a lesser degree of attention to tankers larger than 250,000 dwt. An evaluation of the merits of these twelve designs in comparison to a typical nonsegregated ballast conventional tanker was conducted giving consideration to six types of accident circumstances of concern from the viewpoints of oil outflow, and safety of life and ship.

The principal results of this study showed that:

- As a result of the extra cubic capacity which segregated ballast provides, it should be possible with proper positioning of segregated ballast tanks to achieve a significant measure of additional protection compared to conventional tankers over a range of accident circumstances.

- No unique or best way for positioning segregated ballast was identified and the evaluations showed at least six conceptually different designs offering substantial and approximately equal potential for mitigating the consequences of a variety of tanker accidents.

- The evaluation showed that design concepts attempting to concentrate segregated ballast capacity as a defensive mechanism in one area of the ship only will not provide as well rounded protection against the range of accidents to which tankers are exposed as a more balanced distribution of segregated ballast capacity.

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- The group recognized and supported previous studies indicating substantial benefits operationally for the segregated ballast approach on larger carriers.

Based on these findings and at the Coast Guard's request the group investigated a number of possible regulatory approaches designed to encourage segregated ballast tanker designs capable of some measure of protection in accident circumstances but without specific constraints which would inhibit positive future development of promising design concepts not yet identified. Finally, the group noted that in its collective opinion the most effective measures for preventing accidental pollution and other types of major tanker accidents are those concerned with training and performance of ship's crews, and traffic and navigational improvements for ships of all types rather than further tanker design measures.

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I. Background and Objective

This study was initiated at the request of the United States Coast Guard to study the issue of how best to utilize segregated ballast capacity as a defensive mechanism against accidental pollution. The study group included both government and industry operating and technical professionals who by training and experience were considered uniquely qualified to perform the study. The 1973 IMCO Pollution Convention addresses the issue of operational pollution from tankers; the largest single source of pollution from tankers. This Convention also establishes maximum allowable outflow from accidents. It is hoped that implementation of the Convention should ultimately eliminate a very high percentage of current pollutant levels generated by tankers.

The June 28, 1974 Proposed Rulemaking by the United States Coast Guard provided for an early implementation of the 1973 IMCO Pollution Convention with respect to U. S. Flag tankers in domestic trade. An advance notice of Proposed Rulemaking by the United States Coast Guard (also June 28, 1974) addressed the issue of accidental pollution through proposed regulations which would improve the level of operational standards in U. S. waters. Neither the 1973 IMCO Convention nor the June 28, 1974 Proposed Rulemaking specifically addresses the issue of defensive placement of ballast capacity as a mechanism for reducing accidental pollution. This latter issue was the subject of this study and is a logical extension of efforts to reduce pollution resulting from tanker operations.

The study group's objective was to determine if it was possible to find tanker design concepts with the prospect of useful defensive placement of the segregated ballast capacity implicit in the 1973 IMCO Convention. The group also established that it would attempt to provide recommendations for appropriate regulations.

II. Participants

A contingent of operating and technical professionals from one independent tanker operator and six oil companies assisted the Maritime Administration and Coast Guard in evaluating operational and technical issues. The complete makeup of the study group is outlined on attached Schedule I.

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III. Methodology

The study group met in six full day sessions between the period of February 12 and April 28. Many days of individual participant and subcommittee work were devoted to this study in between the full day committee sessions. The first group project was to obtain, review and analyze all available data on accidents involving both tankers and other cargo ships. The purpose of this analysis was twofold:

1. To determine where ships most frequently get struck (or strike) in collisions, groundings, or rammings (data from tanker and other cargo ships).

2. To determine the frequency of different types of accidents and the resulting pollution outflow from each type of accident (data from tankers only).

The study group then set out to obtain all of the presently available design concepts for the placement of segregated ballast capacity within tankers. This search uncovered concepts which had not generally been discussed in the technical literature.

Each design concept was then analyzed and evaluated with primary emphasis placed on determining its potential for reducing pollution outflow in various types of accidents. The analysis and evaluation also encompassed factors related to safety, stability and salvage after grounding. The analysis of design characteristics was largely a group effort with input from many sources. The final evaluation of relative design benefits was based largely on individual participant assessments.

The unanimity of opinion which resulted from the individual participant's evaluations made it possible for the study group to progress into the area of recommendations on possible USCG regulations for the placement of segregated ballast capacity. These recommendations were directed toward implementing the study groups findings while encouraging the development of new design concepts which would be effective in reducing the levels of accidental pollution.

IV. Informational Sources

The U. S. Coast Guard has made several studies to determine the nature and results of both tanker and general ship accidents. The data from all ship accidents is valid in determining where ships are struck (or strike) in various type of accidents (groundings, rammings, and collisions) based on historical experience.

Appendix A shows the results of a Coast Guard study to correlate damage location with position on the ship length in collision and ramming accidents which resulted in penetration. The data source was a previous IMCO study. Appendix A also shows the results of a similar Coast Guard study to relate damage location on groundings to position on the ship length. Also included in Appendix A are the results of a Coast Guard study of U. S. Salvage Association reports on damage to tankers and cargo ships of 35,000 dwt and larger. Figure 4 plots incidents and penetrations showing both distribution across the bottom (wings versus center) and length along the ship.

Appendix B is a recent report by the U. S. Coast Guard covering a review of worldwide tanker accidents over a five year period. Appendix B was the prime document used by the study group in determining the expected frequency by type of accident and the relative proportion of accidental pollution to be expected from each type. Apendix B also provides relevant data on deaths and injuries resulting from tanker accidents.

The analysis of each design concept required extensive calculations on stability and hypothetical oil outflow under various severities of collision and grounding. A portion of this data was obtained from previous IMCO studies and the files of individual participants. The Maritime Administration provided invaluable assistance in both checking the accuracy of existing data and providing data not otherwise available.

V. Alternative Designs

The study group considered twelve design alternatives for segregated ballast tankers built in accordance with the standards of the 1973 IMCO Pollution Convention. These twelve designs were all analyzed and evaluated in comparison with each other and a conventional nonsegregated ballast tanker. Attached Schedule II provides a schematic outline for each of the thirteen design concepts. A brief description of each design is outlined below. With the exception of Case 1 - Conventional, all other designs comply with the 1973 IMCO convention requirements for segregated ballast capacity.

Case 1 - Conventional - Segregated ballast capacity, if any, carried in small wing tanks.

Case 2 - Staggered Wing Tanks - This design configuration with all ballast capacity in alternate wing tanks should provide maximum protection if groundings or collisions occur at a point involving the ballast wing tanks.

Case 3 - Double Sides - This design provides a continuous but thinner ballast protection area along the entire side of the cargo length.

Case 4 - "J" Wing Tanks - This design concept provides continuous but narrow protection for the entire side walls of the cargo area plus shallow bottom protection throughout the wing tanks.

Case 5 - "L" Wing Tanks - This design, like the "J" design, provides full bottom protection throughout the wing tanks but with deeper protection of that area and partial side shell protection.

Case 6 - Center Line Double Bottom - This design would provide maximum protection against grounding damage in the center tank portion of the bottom.

Case 7 - Full Double Bottom - This design should provide protection against grounding across the entire bottom but with protection to a lesser depth than Case 6.

Case 8 - B/15 Double Bottom Plus Wing Tanks - This double bottom is of lesser depth than in Case 7 but some protective capacity is obtained for a portion of the side shell.

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Case 9 - Forward Double Bottom and Wing Tanks - This design concentrates protection afforded by segregated ballast capacity in the forward half of the tanker with a measure of protection of the side shell.

Case 10 - Double Bottom Wing Tanks - This design should provide maximum protection against groundings throughout the wing tanks only.

Case 11 - B/15 Double Bottom Plus Center Line Tank - This design should provide protection against groundings only.

Case 12 - Double Hull - This design should provide protection across the entire bottom and along the entire side wall of the cargo area. However, the resulting ballast tanks are relatively narrow and do not afford protection against deep penetrations at side shell or bottom.

Case 13 - Center Tanks Only - This design appears to offer minimum protection due to the interior positioning of segregated ballast tanks.

VI. Method of Analysis and Evaluation

The U. S. Coast Guard studies on damage location (Appendix A) were analyzed to determine if strategic placement of segregated ballast capacity could substantially improve the degree of protection afforded against accidental pollution. The U. S. Coast Guard five year analysis on tanker accidents (Appendix B) was reviewed to ascertain the frequency and resultant pollution outflow of the various types of accidents. The study group then made a technical assessment of each of the thirteen tanker designs to determine:

1. Initial Stability
2. Damage Stability
3. Hypothetical Oil Outflow:
   Collision - Two Degrees of Severity
   Grounding - Two Degrees of Severity
4. Salvage Considerations After Grounding (Ability to Recover Ship and Cargo)
5. Susceptibility Fire and Explosion Considerations
6. Impact on Personnel Safety

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These analyses drew upon data from several sources and were agreed upon by the group as a whole. The analysis of items 1-2 were based on International Conventions or the appropriate IMCO formulas. The analysis of item 3 included both the accident assumptions specified in IMCO's hypothetical oil outflow regulation and lesser degrees of damage. The analysis of items 4-6 were necessarily of a more subjective nature but were reached as a group conclusion.

The study group concluded that initial stability and damage stability considerations, as well as strength and capacity problems, could be resolved on each design with varying economic and operational penalties. These items (1 and 2) were dropped from further evaluation as they do not have a direct bearing on accident resistance despite the very real operational and design considerations involved.

Eight of the study group participants then proceeded to complete an individual evaluation of each of the twelve designs. Each individual participant was asked to rank each of the twelve designs on a 1 to 10 basis (poorest to best) in each of the five following categories:

1. Impact on reducing pollution outflow due to collision--major and minor.

2. Impact on reducing pollution outflow due to grounding.

3. Impact on salvage considerations after grounding.

4. Fires and explosion considerations.

5. Impact on personnel safety.

These rankings were based on the technical analysis done by the group.

Each participant was then directed to assign his own weighting (relative importance) factor to each of the five categories on which each design had been ranked. Each participant then established an overall ranking or evaluation of each design. All of the ranking and evaluation work was done independently by each participant. These evaluations were compiled by the U. S. Coast Guard personnel and the results were reviewed and evaluated by the study group. Based on the overall evaluation, the recommendations for appropriate regulations on defensive placement of segregated ballast capacity were prepared.

VII. <u>Results of Analysis and Evaluation</u>

Analysis of the available data on all groundings, collisions, and rammings (see Appendix A) led the study group to the following conclusions:

1. No area of the ship is immune from damage. However, the forward half of the ship appears to be slightly more vulnerable to an accident.

2. The midship half of the bottom appears to be slightly more prone to penetration and grounding than either the forward or aft areas.

3. Wing tanks of conventional width sustain approximately two-thirds of the total bottom damage due to groundings. Penetration from grounding in the wing tank occurs at a ratio of three to one as compared to penetration in center tanks.

4. Bottom damages are generally long but penetrations are generally short.

5. Side damages and penetrations are generally short but it must be recognized that the majority of data supporting this conclusion stems from rammings.

Examination of the data from the five year Coast Guard study on tanker accidents led the study group to the following conclusions:

1. Seventy-nine (79%) percent of all tanker accidents result in zero or negligible pollution outflow.

2. Eighty-one (81%) percent of all oil outflow from accidents results from a small number of incidents (2.4% of the total).

3. The largest single cause of pollution outflow from accidents is structural failure.

4. Pollution outflow from minor grounding incidents is about twice that of the pollution outflow from minor collision and ramming incidents. However, when both major and minor incidents are included, the pollution outflow from grounding is about equal to that from collisions.

5. The number of side and bottom damage incidents are about equal.

6. About 80% of deaths and injuries resulted from fire and/or explosions, many of which followed collisions. There were no deaths following rammings or groundings during this period.

Evaluation of the twelve tanker designs showed that all versions of the segregated ballast tankers should have advantages over the nonsegregated ballast design in reducing pollution outflow. These advantages stem from:

1. Excess cubic capacity and the resultant ability to transfer cargo in an emergency situation.

2. Reduction of human error in handling cargo and ballast.

3. Some degree of protection to the hull in an accident situation.

4. Fewer cargo tank cleaning operations.

The independent evaluations of the eight study group members resulted in a ranking for the twelve designs within three categories which all participants could generally agree upon. The three categories are outlined below:

1. Better Accident Protection

Case 2 - Staggered Wing Tanks
Case 3 - Double Sides
Case 4 - "J" Wing Tanks
Case 5 - "L" Wing Tanks
Case 12- Double Hull

2. <u>Some Improvement in Accident Protection</u>

Case 7 - Full Double Bottom
Case 8 - B/15 Double Bottom and Wing Tanks
Case 10- Double Bottom Wing Tanks
Case 11 -B/15 Double Bottom and Center Line Tank

3. <u>Minimal Improvement in Accident Protection</u>

Case 6 - Center Line Double Bottom
Case 9 - Forward Double Bottom and Wing Tanks
Case 13- Center Tanks Only

The Study group was unable to establish meaningful differences between the value of the design concepts within the top category.

VIII. <u>Sensitivity of Analysis</u>

The ranking of each design on several categories was largely quantitative with such rankings based on calculations carried out under International Conventions or IMCO formulas. These rankings were largely a group effort. The weighting factor (relative importance) placed by each participant on the five categories is highly subjective. The task of weighting the relative value of protecting the environment from grounding accidents as compared to collision accidents is difficult enough. Weighting environmental values against considerations of personnel safety is even more difficult. As might be expected, there was a wide range of values assigned to the weighting factors by the various participants. A summary of the weighting factors used is shown on attached Schedule III. Schedule III shows the lowest, highest and average weighting factor (percentage importance) used by the participants. The sum of each participant's factors totals 100%.

A review of Schedule III shows that one participant placed a value on the importance of protecting against grounding of 54.5%; almost twice the group average. That same participant placed a much lower value on categories 3-5 which relate to salvage,fire and explosion, and safety. A review of that participant's overall evaluations provides a good insight into the sensitivity of this analysis. The participant who placed the high value on protection against groundings came up with six preferred (best) designs. These were:

Case 2 - Staggered Wing Tanks
Case 4 - "J" Wing Tanks
Case 5 - "L" Wing Tanks
Case 7 - Full Double Bottom

Case 8 - B/15 Double Bottom and Wing Tanks
Case 12 - Double Hull

Four of these six designs (Cases 2, 4, 5, and 12) match the overall group evaluation. The remaining two (Cases 7 and 8) fell in the middle category. Several of the participants requested various members of their organization to assign relative importance factors. They found a wide divergency of opinion on an internal basis as to the relative importance of various categories but determined that they always came up with the same general group of best designs no matter what scale of relative importance they used. In summary, it appears that the evaluation system established by the study group is very valid in that it yields consistent results over a wide range of input values.

IX. Conclusions and Recommendations

The study group concluded that some general guidelines on the placement of segregated ballast for defensive purposes in preventing accidental oil outflow would be appropriate. The study group found several designs superior to others in this regard but could not make any overwhelming choice between those superior designs. The study group concluded that there is no design basis which would prevent the catastrophic accident except as it minimizes the possibility of explosion and fire after a collision. The study group also concluded that several locations of ballast placement may reduce hypothetical outflow from collision. Some such designs increase the probability of some outflow as compared to the double hull concept (Case 12) but can sustain more damage while yielding lower outflow. Inspection of the available accident data together with the results of the design analysis suggests that segregated ballast capacity should be placed adjacent to the shell and that at the bottom it should preferably be outboard.

The study group expected to find some preference for forward placement as compared to aft placement but this preference does not seem to be supported by experience or analysis. The study group concluded that it could accept a regulatory proposal encompassing only the fundamental guideline above which would encourage designs meeting its intent and exclude designs which would not. The group further recommended that because of the several design approaches which appear to offer significant benefit in accident circumstances, it could not recommend a regulatory approach which would specify one type of design concept only and thoroughly rule out positive further development of promising new concepts. At the request of USCG the group attempted to develop a more precise approach to possible regulations which would specify the general guidelines. This resulted in the formula appearing in Appendix C.

X. Testing of Recommendations and Formula

Using the designs available the formula was tested to determine if it produced results consistent with the study findings for location of segregated ballast. It was found that the formula:

- provides incentive to place ballast at the shell generally, and outboard at the bottom, i.e., the area of greatest vulnerability.

- provides some incentive to reduce calculated hypothetical oil outflow.

- tends to include the design concepts found advantageous and exclude those found less advantageous.

- allows flexibility for further design development.

The group recognized that it was not possible to test all possible design concepts, and especially unusual designs, and therefore, recommended that a formula approach must be subject to an equivalency determination to allow for unusual concepts not explored.

XI. Limitations of the Study

This study was necessarily carried out within a limited time frame. Every effort was made to include all of the creative thinking and analysis work that various industry and government groups had already developed on this subject. The study group expressed a good deal of its own creative ability but the possibility remains that there are other design concepts which might exist and be found advantageous. The time limitation also forced the study group to do most of its evaluation on designs in the 120-250,000 dwt size range with lesser attention to ships up to 500,00 dwt. Different design alternatives might be more or less advantageous on ships which fall outside the 120-250,000 dwt size range. The study group also necessarily focused its attention on designs with conventional ratios of length to beam to depth. The same problems may apply with designs which are not conventional in this regard. The study group also recognizes that a correction factor to the formula may be necessary for ship sizes larger than those primarily studied. Time limitations again precluded particular consideration of this item. There is almost no quantitiative data available which relates resulting internal structural integrity to the depth of accidental penetration. The study group used the same approach as in the IMCO hypothetical outflow regulation in regard to the point of penetration. While this is a simplified assumption, it should provide a relative measure of differing designs in accident circumstances.

Schedule I

SEGREGATED BALLAST TANKER STUDY - SHIP CONFIGURATION

PARTICIPANTS

Name	Affiliation	Location
W. O. Gray, Chairman	Exxon Corporation	New York, NY
J. Christopher	Chevron Shipping Company	San Francisco, CA
P. C. Dahan	Mobil Shipping & Transportation Company	New York, NY
S. J. Dwyer	Gulf Oil Trading Company	Philadelphia, PA
R. Y. Edwards	American Institute of Merchant Shipping	Washington, DC
J. T. Jacobson	The Standard Oil Company	Cleveland, OH
R. K. Kiss	United States Maritime Administration	Washington, DC
T. Lamb	Hydronautics, Inc.	Laurel, MD
R. L. May	Texaco, Inc.	New York, NY
R. I. Price	United States Coast Guard	Washington, DC
R. A. Sutherland	United States Coast Guard	Washington, DC

SEGREGATED BALLAST TANKER STUDY - SHIP CONFIGURATION

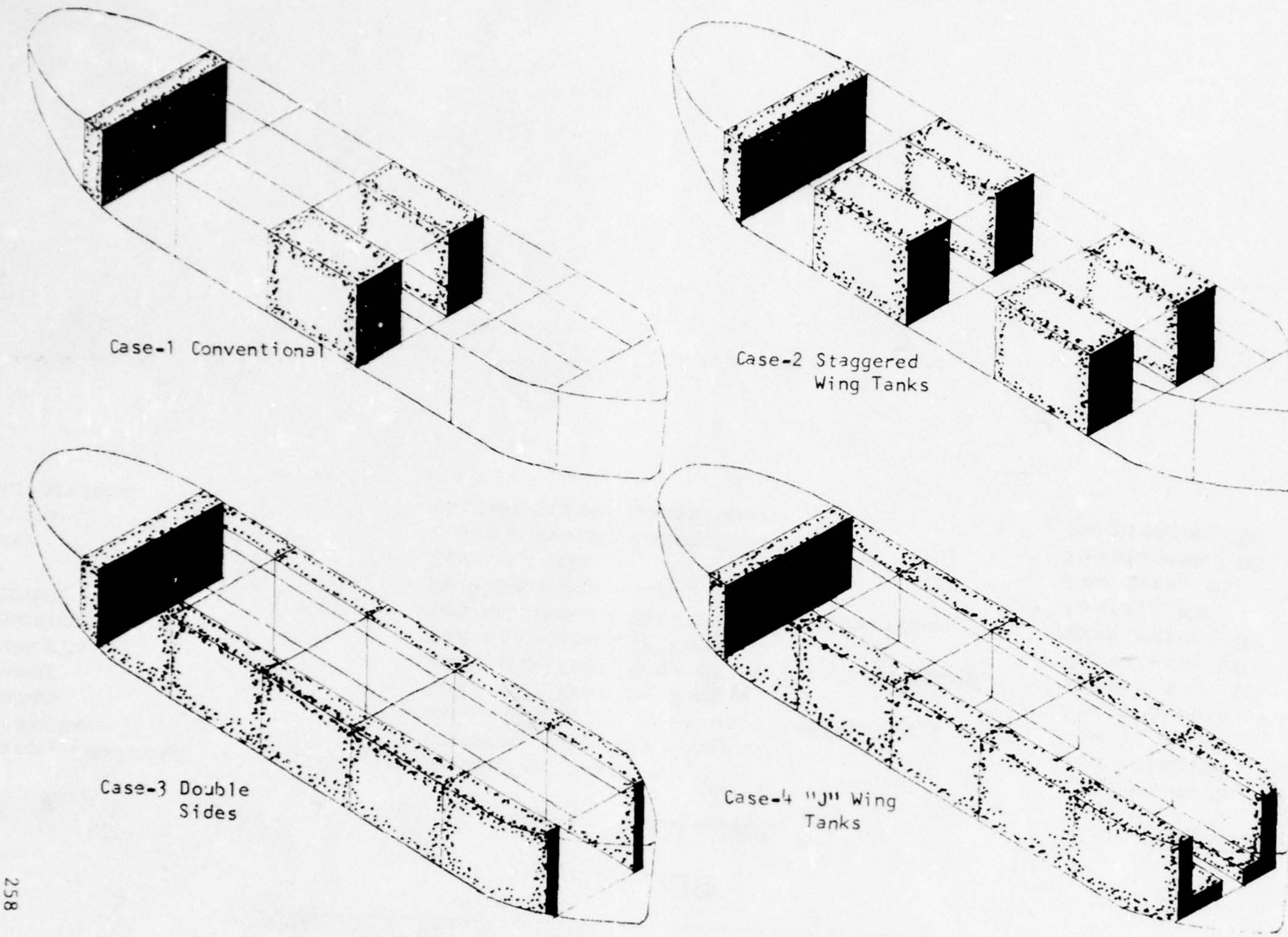


Figure-1

Note, not drawn to scale.

~~Schedule II~~

SEGREGATED BALLAST TANKER STUDY - SHIP CONFIGURATION

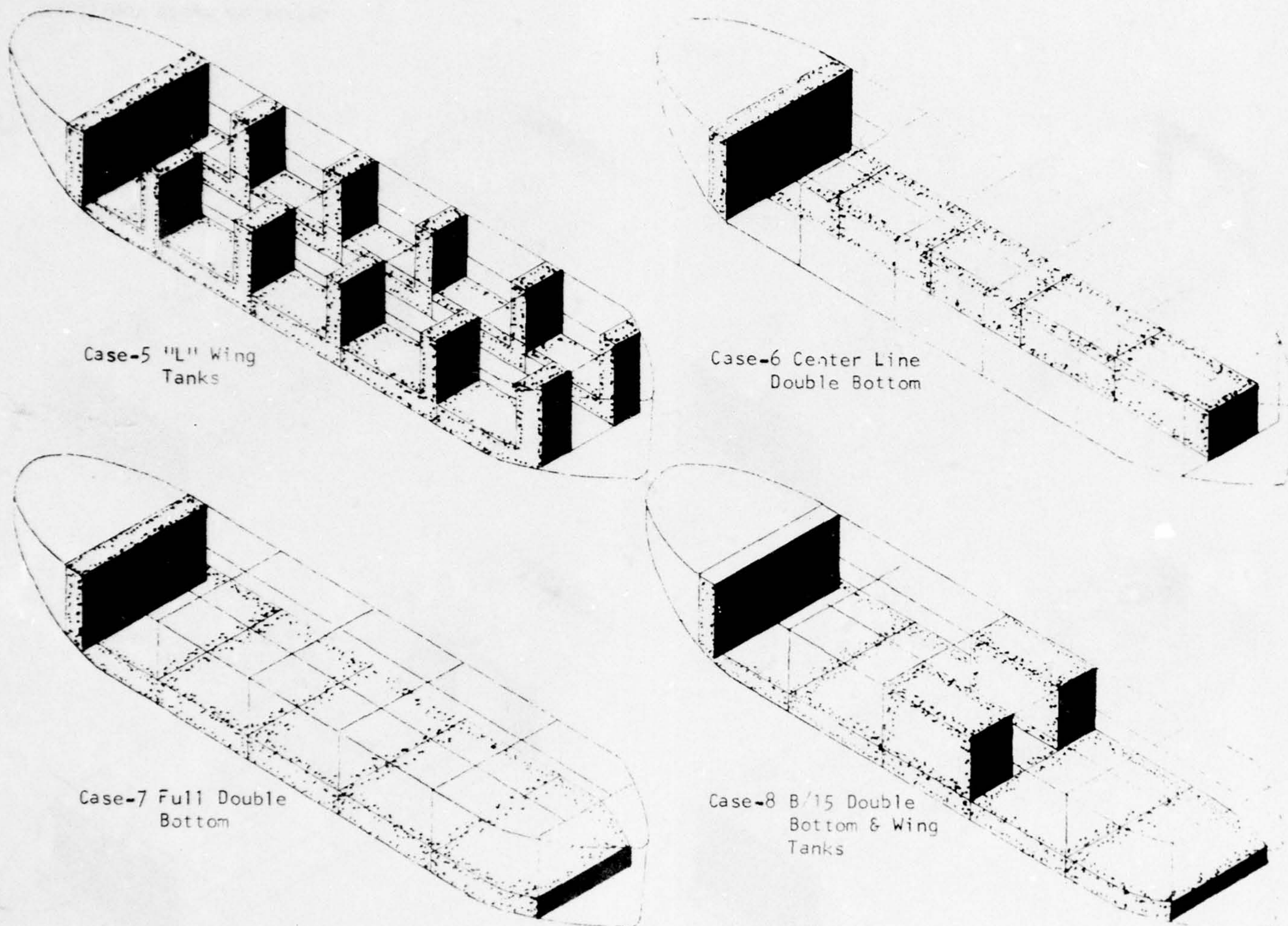


Figure-2

Note, not drawn to scale.

~~Schedule II~~

~~Schedule II~~

SEGREGATED BALLAST TANKER STUDY - SHIP CONFIGURATION

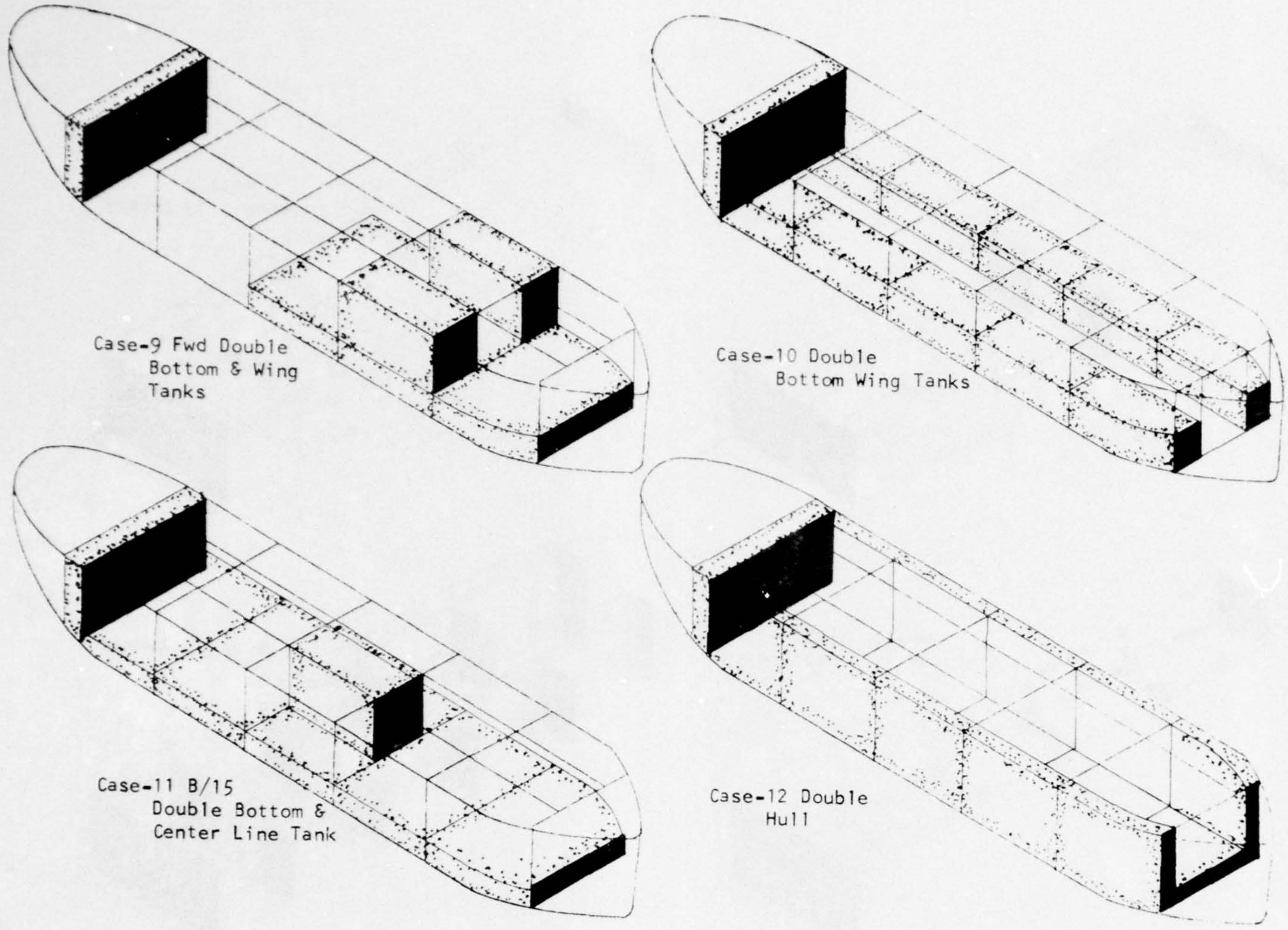
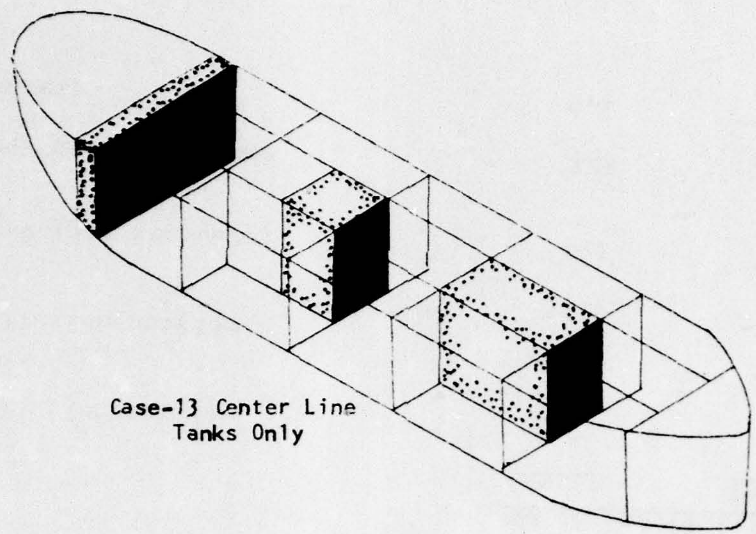


Figure-3

Note, not drawn to scale.

SEGREGATED BALLAST TANKER STUDY - SHIP CONFIGURATION



Case-13 Center Line
Tanks Only

Note, not drawn to scale.

Figure-4

~~Schedule III~~

SEGREGATED BALLAST TANKER STUDY - SHIP CONFIGURATION

SUMMARY OF WEIGHTING FACTORS USED

Category for Tanking	Weighting (Relative Importance) Factors		
	Lowest	Highest	Average
Impact on reducing pollution outflow due to collision	16.0	48.8	28.8
Impact on reducing pollution outflow due to grounding	11.7	54.5	28.3
Impact on salvagability (oil recovery) after grounding	6.1	35.8	21.6
Susceptability to fires and explosions	5.0	12.5	8.4
Impact on personnel safety	6.1	24.0	12.9
			100.0

XIII. APPENDICES

A. Damage Distribution

In preparation for this study the Coast Guard assembled information on the location and extent of damage to vessels as a result of collision, ramming and grounding type accidents. The information provided by the Coast Guard and considered by the working group is presented in this appendix.

Two primary information sources were used: IMCO damage cards and a selected sample of U. S. Salvage Association damage survey reports.

Figure ~~1 shows~~ the distribution of collision damage centers along ship's length developed as a result of IMCO work to update passenger vessel subdivision requirements. This work, described in reference (1), resulted in definition of a subdivision index, based on probabilistic treatment of ship survival in case of collision. An investigation of longitudinal location of damage was one phase of this work. From 811 reports of damage forwarded to IMCO, 296 cases of ships struck by another ship were selected and used as a basis for longitudinal damage distribution.

The IMCO report concluded that:

> "Inspection of histogram (Fig. 4.18) of the nondimensional damage location shows that damages in the forward half of the ship are more frequent than in the after part. No explanation can be offered for the peaks of the histogram at about X/L = 0.45 and X/L = 0.95 except that they are random because of the limited sample.

Figures 2 and 3 are based on information from IMCO damage cards contained in references (2) and (3).

Reference (4) provides background on IMCO damage cards and a discussion of some of the uncertainties involved in using them as an information source.

Figure 4 shows the results of another effort to determine damage distributions. Approximately 600 reports of damage to tankships, bulk carriers, and combination ships (ore/oil, bulk/oil) over 35,000 DWT occurring during 1969 - 1973 were reviewed.

This included 220 reports of damage resulting from stranding, collision, striking an underwater object, or ramming a pier, lock wall, dolphin,etc. Damage due to heavy weather was not included. Reports may be grouped as follows:

Damage in Cargo area		
Hull penetrated		
Side	19	132
Bottom	15	
Hull not penetrated		
Side	70	
Bottom	28	
Damage outside Cargo area	88	
Total -	220	

Based on information in reports, estimates of location and longitudinal extent of hull damage were plotted on profile and plan view of a tankship (profile stretched vertically, plan view stretched athwartships to accommodate information) in an attempt to discover patterns of damage locations. The thin lines indicate the longitudinal location and extent of damage; heavy lines indicate actual penetration of the hull. Only incidents involving damage to the hull within cargo tank length are plotted. Bottom damage is shown within port of starboard wing tanks or center tank; beyond that athwartships locations of lines have no significance. Damage for both port and starboard sides has been shown on starboard profile. Vertical location of lines has no significance, except, where report clearly indicated damage to sheer strake or near turn of bilge, an attempt was made to show damage in that area. Damage locations and extents are approximate and were plotted on basis of ratio of damage length to ship's length.

Areas of uncertainty inherent in this review include:

1. Sample validity (none of ships were total losses, is group of ships surveyed representative?)

2. Approximations and estimates of damage extent made on basis of information in reports (Damage often reported in terms of plate numbers or frame numbers, no plans available, reports not specific, etc.).

~~Appendix A~~

References

1. IMCO Marine Safety Council Circular 153, "Regulations on Subdivision and Damage Stability of Passenger Ships as Equivalent to Part B of Chapter II of the International Convention for the Safety of Life at Sea, 1960 (Resolution A.265 (VIII)); Explanatory Notes to the Regulations," 28 November 1973, in Commandant's International Technical Series - Volume IV, Regulations on Subdivision and Stability of Passenger Ships as equivalent to Part B of Chapter II of the INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1960, Report No. USCG CITS-74-1-1, available from NTIS.

2. "Statistics on Grounding and Stranding Damage," IMCO document DE/27, 6 May 1970.

3. "Grounding Casualty Statistics," IMCO document DE V/3, 8 May 1970.

4. James C. Card, "Effectiveness of Double Bottoms in Preventing Oil Outflow from Tanker Bottom Damage Incidents," Marine Technology, Vol. 12, No. 1, January 1975.

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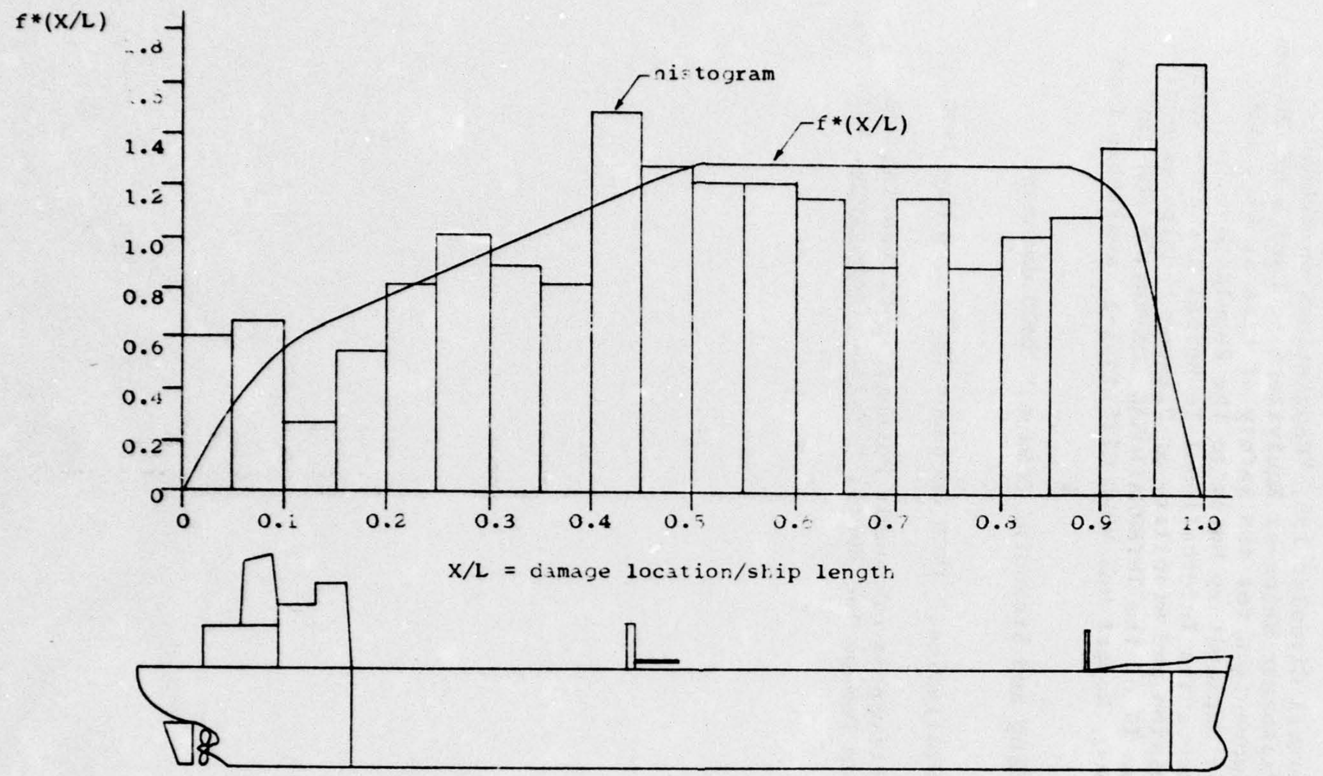


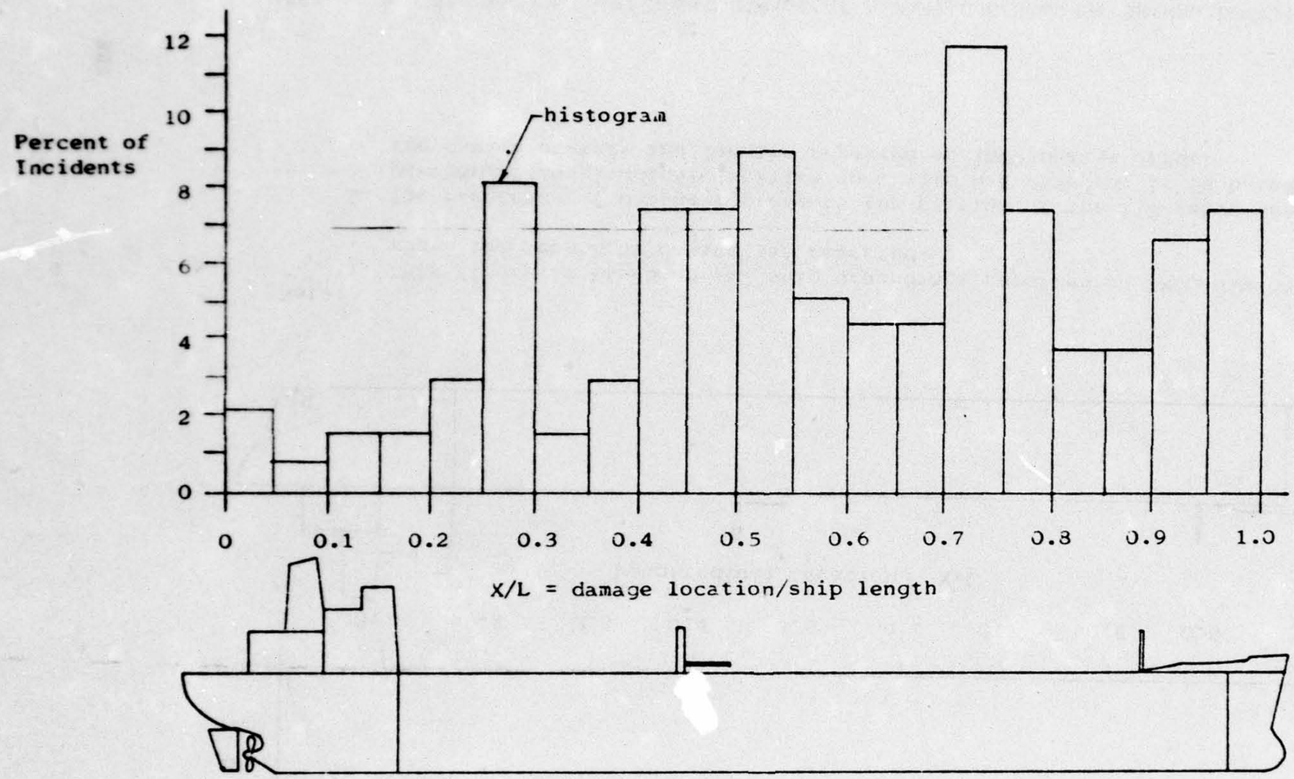
Note:

1. This figure is taken from Figure 4.18 of reference 1..

2. Histogram is based on 296 ships struck in collisions reported on IMCO damage cards. These ships were of all types, the data cover a period of years (1948-1965), and do not include newer ships.

3. The function f*(X/L) is the assumed damage density distribution along the ship's length used in Regulation 6- Attained Subdivision Index A of the new equivalent system of international regulations on the subdivision of passenger ships, adopted in November 1973 by IMCO.

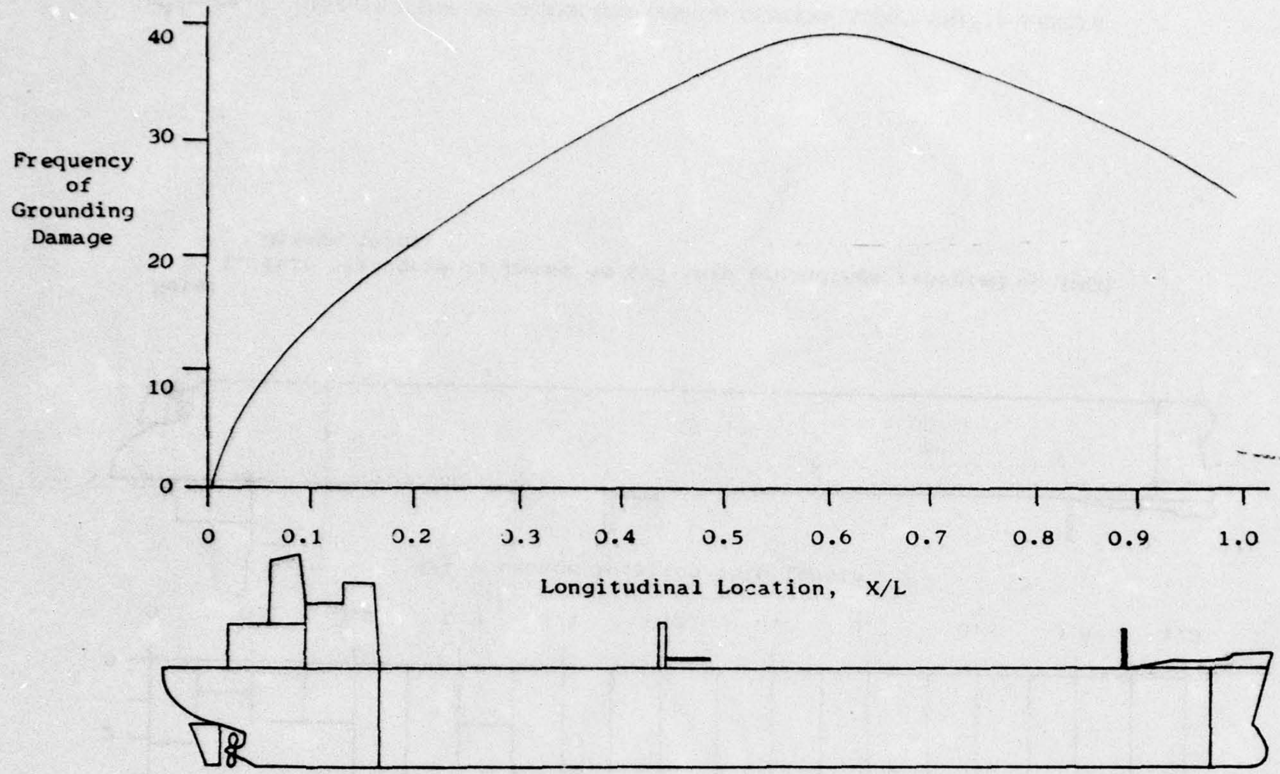
Figure 2 DISTRIBUTION OF COLLISION DAMAGE CENTERS ALONG SHIP'S LENGTH



Note:

1. This histogram is based on 135 ship groundings reported on IMCO damage cards.

Figure 3 DISTRIBUTION OF GROUNDING DAMAGE CENTERS ALONG SHIP'S LENGTH



Note:

1. This figure is based on 112 ship groundings reported on IMCO damage cards where the length of damage was reported.

2. The frequency of damage represents the portion of the 112 cases where a particular longitudinal location on a ship was damaged. It is based on the damage centers and lengths reported on IMCO damage cards.

Figure 4 FREQUENCY OF GROUNDING DAMAGE AT A PARTICULAR LONGITUDINAL LOCATION

Reprinted from Proceedings of the 1975 Conference on Prevention and Control of Oil Pollution, March 25-27, 1975, San Francisco, Calif. Sponsored by: American Petroleum Institute, Environmental Protection Agency, and United States Coast Guard

TANKSHIP ACCIDENTS AND RESULTING OIL OUTFLOWS, 1969-1973

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ABSTRACT

Information has been collected on 3,715 worldwide tankship accident involvements during the period 1969-1973 from Lloyd's Weekly Casualty Reports and other sources. Scope of the effort, assumptions and definitions used in data collection, and uncertainties about data are described. For 3,183 involvements of tankships over 3,000 deadweight tons, frequencies of occurrence of breakdowns, collisions, explosions, fires, groundings, rammings, and structural failures are presented. Failure consequences including deaths, injuries, vessel damage, and accidental oil outflows are tabulated and relationship of vessel size, age, and location of involvement are examined. Information collected, once analyzed, should be useful in evaluating measures for reducing accidents and resulting oil outflows and evaluating risks associated with oil transport and production decisions.

INTRODUCTION

Information is an essential prerequisite for understanding and intelligent decision making. Information on tankship accidents is essential to identify hazards and evaluate risks associated with marine transportation of oil and to make intelligent decisions concerning laws and regulations affecting vessel design, construction, operation, and traffic-control systems. Because of decision complexity, systematic approach is essential if we are to make the right choice. The need for a systematic approach to marine transportation safety is recognized in the Ports and Waterways Safety Act of 1972, which gives the Secretary of the Department of Transportation and the U.S. Coast Guard broad regulatory authority over tank vessel design and operation as well as authority to establish vessel traffic-control systems. The act provides that a number of factors must be considered in developing regulations; among them are the scope and degree of hazard, vessel traffic characteristics, port and waterway configuration, environmental factors, economic impact, extent to which proposed rules will contribute to safety or protection of the marine environment, and their cost and technical feasibility [1]. Information about tankship accidents is essential to understanding the influence of each of these factors on safety and environmental protection.

There have been a number of studies of tanker accidents over the last few years. The effort reported here originated in 1971 when Porricelli, Keith, and Storch recognized that although tanker casualty information was available from various sources, there was no composite collection of information on international tanker casualties which included pollution data [2]. Porricelli et al. reported and analyzed 1,416 tanker casualties with the associated 269 polluting incidents occurring during 1969-1970. Porricelli and Keith later added information on oil outflow amounts for the 269 polluting incidents [3]. Reference 4, compiled for the Coast Guard by the naval architectural firm of J.J. Henry Company, Inc., extended the data base to include 1971 and 1972. The information presented here includes both these efforts and adds 1973 for a total of five years.

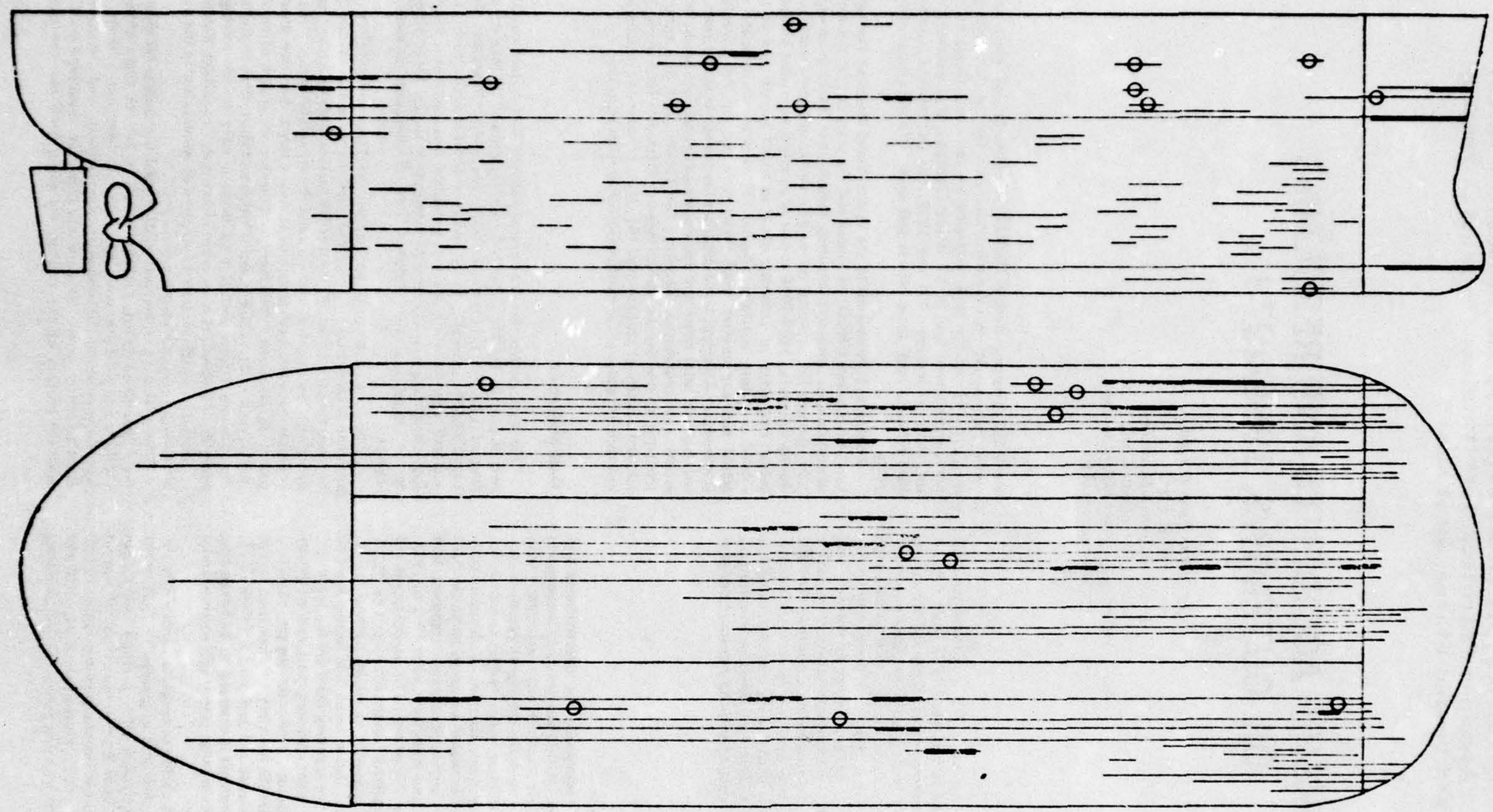
Reference 5, submitted to the International Maritime Consultative Organization (IMCO) by France and discussed in [3], presented information on incidents involving tankers over 7,000 deadweight tons. Grimes [6] reported on 13,379 tanker accidents worldwide during the period 1959-1968 as part of an effort to predict probable future frequency of accidents likely to result in pollution of the United Kingdom coastline. Quaille [7] presents information on actual and constructive total losses collected by the Liverpool Underwriters Association and discusses the growth in recent years of constructive total losses and the worsening tanker loss ratios, both actual and constructive. Recently, the Tanker Advisory Center, a reporting service for the tanker industry located in New York, has released reports of tanker losses [8]. Most of these efforts have not included estimates of oil outflows resulting from accidents.

Data collection

The basic source for the tanker accident information reported here is *Lloyd's Weekly Casualty Reports*, published by the Corporation of Lloyd's at Lloyd's, London, England. Information from Lloyd's has been supplemented and cross-checked with Coast Guard accident and pollution reports, published news accounts, *Lloyd's Register of Shipping Casualty Returns*, published by Lloyd's Register of Shipping, and information from oil companies in some instances.

Some terms need to be defined for the discussion to follow. An *accident* is an unexpected and undesired event. It may involve one or more vessels. An *involvement* is the participation of a vessel in an accident. One vessel in one accident results in one involvement. A collision between two tankships is one accident but two involvements. *Involvement type* refers to categories or groups of involvements, such as breakdowns, collisions, groundings, fires, explosions, etc. The term *total loss* is used here to refer to the sinking or breakup of a vessel; it is an event rather than a condition. The term *accidental oil outflow* refers to oil cargo or bunkers lost to the sea as a result of a tankship involvement.

The marine transportation system used for moving oil includes the following elements: tankships; tank barges and tugs; terminals (onshore and offshore) with their piers, pipelines, buoys, tanks, and other components; the transportation pathway; and the environment (weather, wind, currents, etc.). We are concerned with the tankship portion of the system, the vessel itself plus the factors



Longitudinal location and extent of damage:
location and extent of hull penetration shown by heavy line
report indicates hull was penetrated, but details of location and extent not reported
hull not penetrated

Note that one incident may have resulted in more than one penetration or damage to more than one area of the bottom (center, port or starboard wings).

Figure 5. LONGITUDINAL LOCATION OF DAMAGE TO SIDE AND BOTTOM PLATING WITHIN CARGO AREA FROM 132 DAMAGE SURVEY REPORTS.

influencing its performance. These factors may be categorized as human, equipment, cargo, path, or environment [9]. The tankship performance goal is the safe and efficient transportation of oil cargo from the loading terminal to the discharge terminal. Accidents are undesired events which keep us from achieving that goal.

Figure 1 shows the relationship between the system factors, undesired failure events, and failure consequences. A successful voyage from point A, the loading terminal, to point B, the discharge terminal, can be represented by a straight line connecting the two points. A voyage can change from a success to a failure due to occurrence of a failure event. Failure events result from interaction of the tankship system and various system factors. Each of the failure events can result in *failure consequences*. Some of the most common are listed. We are interested in several things. One is the *probability* of an undesired failure event occurring. Another is the *severity* of the consequences associated with such an event. And when it comes time for decisions on action to reduce the probability and severity of failure events, we need to consider *cost* and *effectiveness* of the alternative actions available to us.

The scope of this study includes ship-movement accidents to tankships carrying oil. Tank barges are not included. Combination carriers, such as ore/oil and bulk/oil vessels, are included if the accident occurred while the vessel was in tanker service. Not included are incidents of hostile action, shipyard accidents, machinery derangements not requiring tow to port, and loading and discharge mishaps such as broken hoses and overfilled tanks. Fires, explosions, sinkings, and capsizings occurring while a ship is at a pier are included even though the ship was not "moving." *Oil* includes petroleum in any form; tankships carrying wine, grain, molasses, sludge, fish oil, vegetable oil, or the like are not included. Casualties to oil/chemical carriers are included even if cargo was not petroleum. These are coded so they may be studied separately, as are the involvements of liquefied gas tankships.

The data record of tankship involvements covers the five-year period 1969-1973. For each involvement the following information is recorded:

Vessel name
International call sign
Country of registry
Gross tonnage
Deadweight tonnage
Year vessel built
Type of involvement
Month and year of involvement
Ship's loading condition
Occurrence and amount of oil outflow
Method used to determine amount of outflow
Severity of damage to the vessel
Portion of vessel involved
Number of persons killed or injured
Geographical area of involvement
Relation of area to land and harbors
Source of information

Since the results are influenced by the assumptions made in data collection, some of the more important ones are worth noting. In determining involvement type, if more than one undesired event occurred (ship goes aground after a breakdown) the whole chain of events was considered an involvement of the type that first occurred. *Breakdown* includes cases where the vessel lost propulsion power or anchored when loss of propulsion power seemed imminent, and later was towed to port for repairs. Cases where a vessel proceeded to port under its own power after making repairs were not included. *Collisions* are limited to cases of a tankship striking or being struck by another vessel. *Ramming* includes tankship hitting a pier, breakwater, lock wall, dolphin, or other similar fixed object. Reports of "striking a submerged object" were

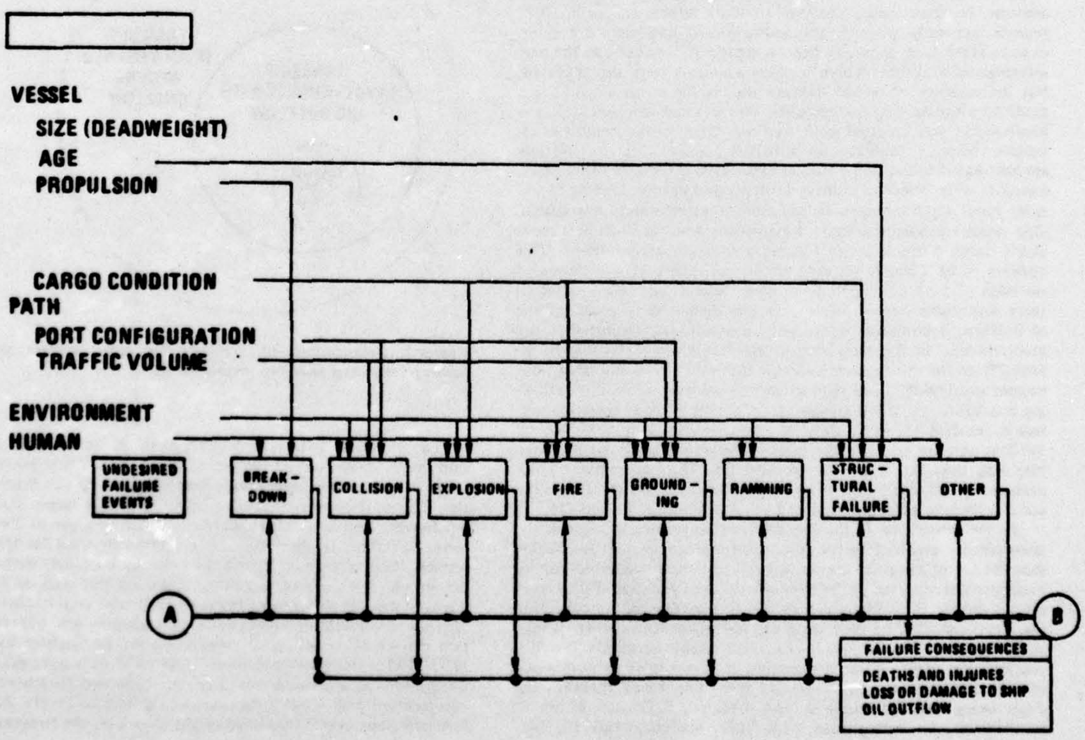


Figure 1. Tankship system failure diagram.

considered rammings unless it was apparent from the report that the object struck was some part of the bottom. *Groundings* include strandings where the ship remained aground for some time, as well as "touching bottom" and striking a submerged object where it appeared from the report that the ship contacted the bottom. *Structural failures* include tankships breaking up and reports of "heavy weather damage" ranging from shell plating failure down to damaged piping, catwalks, bulwarks, and the like on deck due to boarding seas. Failure of structural components due to deterioration with age, inadequate design, or unusual loadings are all included. The category *other* includes those involvements not fitting into one of the previous categories. Capsizing of a tankship or sinking at the pier due to flooding of machinery space are two examples of involvement in this category.

The severity of damage to a tankship was recorded as one of the following:

1. *Sunk*, including cases where a vessel broke in two and part of it sank, or where the vessel was raised later;
2. *Heavily damaged*, where hull structure was weakened so ship was in danger of breaking up, a major fire occurred involving most of ship, or other damage was sustained with estimated repair costs exceeding $250,000. Note that this category would include a number of ships regarded as total losses or constructive total losses for insurance purposes, even though the vessel did not actually sink;
3. *Light damage* includes cases where ship was not in danger of sinking and estimated repair costs were less than $250,000;
4. *No damage* includes all cases where no damage or only superficial damage occurred.

Location of tankship at the time the accident occurred is given in terms of a two-digit code for the area of the world's oceans and a code for pier, harbor (including rivers and canals), entranceway to harbor, coastal area (within 50 miles of land), or at sea (over 50 miles from land).

Probably the most difficult part of the data collection, the one subject to the most uncertainty, and yet one essential to the whole effort is the problem of determining oil-outflow occurrence and amount. In some cases, outflow amounts appear in the incident reports, generally without any indication of how they are determined. These have generally been accepted at face value as the best information available. Where outflow amounts were not reported, but information on vessel damage was available, an attempt was made to estimate outflow amounts. Where a loaded vessel sank, the involvement was credited with outflow equal to the vessel's deadweight. Where a tankship on a ballast voyage sank, an outflow amount equal to the ship's bunker capacity was used. In other cases, amounts were based on damage location and extent, loading condition, tanks reported open to sea, and other information available. One serious problem is that of estimating what portion of a tankship's cargo burns if a fire follows a collision or grounding. This appears to be a highly variable factor and each case was estimated on basis of best information available. Where the report indicated there was visible sign of oil outflow but there was no great volume of outflow, a minimum quantity of one ton was attributed to the involvement. In the remaining involvements where it could be inferred from the information available that oil outflow did occur, but neither outflow data nor damage details were available, the following procedure was used: It was assumed that none of these involvements resulted in an outflow greater than 500 long tons. An oil outflow amount equal to the mean value of the outflows less than 500 long tons for similar involvement type (*e.g.*, groundings, collisions, etc.) was attributed to each of these involvements. This is the same procedure used and discussed at some length in [3 and 4].

Before moving on to the data analysis, let us look at some of the uncertainties involved in the data collection process. It is possible that the list of tankship involvements is not complete, either due to incidents not reported in the data sources used or because they were missed during the collection process. Experience during collection and cross-checking of data supports the belief that the list is relatively complete, particularly for the more serious accidents. It is also possible that some of the information recorded is not accurate due to misreading reports or miscoding data. This could include incidents being included which do not meet our definition of tanker involvement, or wrong data, year built, loading condition, etc., being recorded. Again, cross-checking and rereading reports, particularly for more serious accidents, gives confidence that relatively few errors of this type remain.

There is also uncertainty regarding outflow amounts, considering the quality and amount of information upon which these figures are based. In fact, even the reported values are probably no more than estimates. The problem of estimating what portion of a tankship's cargo burns after collision or grounding is particularly troublesome considering the influence that a few large outflows have on overall amounts. All of the outflow amounts must be considered estimates and used with caution. The figures on deaths and injuries reported in the information sources have been accepted at face value, and no specific effort has been made to verify or cross-check them since the overall loss of life and injury occurrence are not large.

Data analysis

During the course of tankship operations, some undesired failure events or tankship involvements which interrupt the trip from A to B may occur. Some (we hope all) of these involvements are reported and are now accurately represented in our data file. Figure 2, representing our data records, shows how reported tankship involvements can be subdivided into those with oil outflow and those without oil outflow. And some portion of those involvements where damage is serious enough to result in outflow also result in sinking of the tankship. (Because of the outflow assumptions we have made, any sinking is considered to result in outflow, although it is not uncommon for oil to remain in intact tanks rather than escape immediately to the sea when a vessel sinks.)

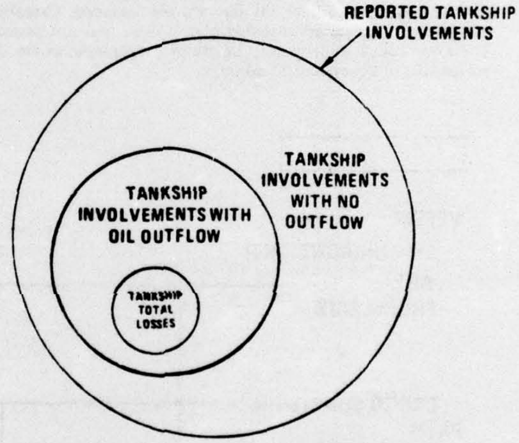


Figure 2. Relationship of involvements with outflow and total losses to reported tankship involvements.

The complete data record contains information on 3,715 tankship involvements during the period 1969-1973. These involvements range in seriousness from minor bumps and scrapes to major casualties. The analysis reported here includes vessels larger than 3,000 deadweight tons, which is roughly equivalent to a size of 2,000 gross tons. Tankships smaller than this are generally used for specialized service, such as product distribution among terminals within a harbor or on short coastwise routes. They are not used on long-haul voyages and the differences between them and larger ships warrant separate consideration. The choice of a dividing line between these two classes of vessels is of some concern. An analysis by Exxon [10] of the previously published 1969-1970 data used 6,000 deadweight tons as a dividing line. Further study and discussion of fleet composition and vessel utilization would help to clarify this point. For tankships over 3,000 deadweight tons, over the five-year period

there were 3,183 involvements. Of these, there were 452 involvements where accidental oil outflows totaling an estimated 950,000 long tons occurred. During the period 1971-1973 there were 381 reported deaths and 178 injuries.

Referring back to figure 1, we will look first at the frequency of occurrence of the various undesired failure events and the resulting failure consequences. Then we will look for relationships between some of the system factors and the failure events.

The frequency of occurrence during the five-year period of the various undesired failure events or involvement types is shown in table 1, and the percentage figures are shown graphically in figure 3.

Table 2 shows the distributions of deaths and injuries among accident types for the period 1971-1973. Collisions and explosions account for the bulk of deaths and injuries; and, in fact, most of the deaths and injuries caused by collisions are the result of fire or explosion following the collision. The total of 381 deaths over three years is not a very large number–approximately 1,500 persons are killed in the U.S. every year in recreational boating accidents, therefore, the loss of life associated with tankship accidents is not great. Table 3 presents information on loss or damage to tankships resulting from involvements. These must be thought of in terms of repair or replacement costs, lost revenue, sailing delays, and increased insurance premiums. The true cost of these depends a great deal on tanker, shipyard, and insurance market conditions.

Table 1. Tankship involvements, 1969-1973, tankships over 3000 deadweight tons

TYPE OF INVOLVEMENT	NUMBER
Breakdown	355
Collision	744
Explosion	104
Fire	197
Grounding	790
Ramming	473
Structural Failure	515
Other	5
TOTALS	3,183

Information on oil outflows appears in table 4 and is shown graphically in figure 4.

Size distribution of oil outflows for various involvement types is shown in figures 5 and 6. Most outflows resulting from breakdowns and rammings and fires are relatively small (90% less than 850 long tons). Outflows resulting from collisions, groundings, explosions, and structural failures tend to be larger as indicated in Figure 6.

Table 5 shows that most of the total oil outflow (81%) is a result of tankship sinkings, even though less than 2% of all tankship involvements result in the vessel sinking. The 15 vessels lost due to structural failure accounted for 34% of the total oil outflow from tankship accidents. Because of their contribution to oil outflows, a more detailed study was made of tankship total losses. There were 47 tankships of over 10,000 deadweight tons that were total losses during the 1969-1973 period. They were responsible for 81% of the total oil outflows of 951,000 long tons. Table 6 shows that most of these involved a sequence of failure events. Table 7 gives additional detail on the events leading to loss of structural integrity and sinking of the tankship.

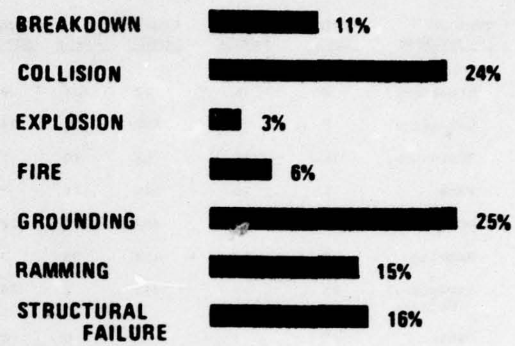


Figure 3. Distribution of tankship involvements, 1969-1973, tankships over 3000 deadweight tons.

Table 2. Deaths and injuries resulting from tankship accidents, 1971-1973, vessels over 3000 deadweight tons

Accident Type	No.	Deaths	Injuries
Breakdown	4	5	53
Collision	26	259	130
Explosion	33	46	47
Fire	14	34	10
Grounding	0	0	0
Ramming	0	0	0
Structural Failure	6	37	32
Other	0	0	0
TOTALS	83	381	178

NOTE: Deaths and injuries include those occurring on other vessel or ashore as a result of the accident.

This kind of information on the occurrence of various failure events and their consequences should help us answer questions such as, Given a failure of a given type, what is the probability of various losses or failure consequences occurring? Referring again to figure 1, we will now look for relationships between some of the system factors and the failure events in an attempt to better understand accident experience. Since our interest here is in preventing accidental oil outflows, we will look at the 452 cases (14.2% of all involvements) where outflow occurred.

Vessel size is an important and impressive variable whenever tankships are talked about. Figure 7 gives the distribution of tankship size and also the distribution of deadweight tonnage or cargo-carrying capacity as of July 1971 (the midpoint of the five-year period) for reference purposes. Figure 8 gives the distribution of involvements where outflow occurred and the outflow amounts.

Table 3. Damage or loss of tankships, 1969-1973, tankships over 3000 deadweight tons

TYPE OF INVOLVEMENT	TOTAL LOSS	HEAVY DAMAGE	LIGHT DAMAGE	NO DAMAGE	DAMAGE UNKNOWN
Breakdown	2	16	197	131	9
Collision	7	64	570	78	25
Explosion	11	30	52	10	1
Fire	1	26	149	14	7
Grounding	12	63	487	206	22
Ramming	0	23	412	35	3
Structural Failure	15	39	445	2	14
Other	3	1	1	0	0
TOTAL	51	262	2313	476	81

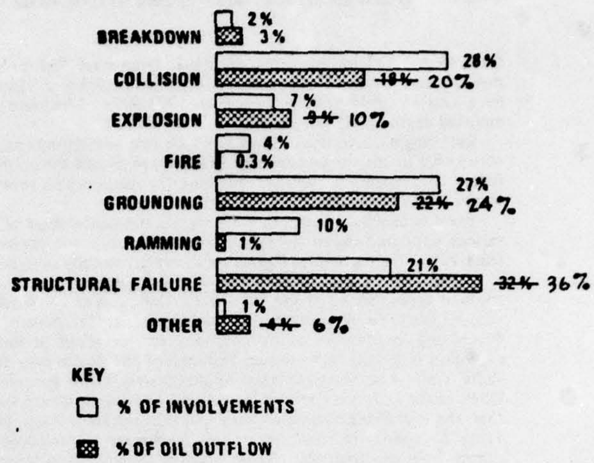


Figure 4. Distribution of involvements resulting in oil outflows and amount of oil outflow, 1969-1973, tankships over 3000 deadweight tons.

Table 4. Tankship involvements resulting in oil outflow, 1969-1973, tankships over 3000 deadweight tons

INVOLVEMENT TYPE	NUMBER RESULTING IN OUTFLOW	AMOUNT OF OIL OUTFLOWS (Long Tons)
Breakdown	11	29,940
Collision	126	185,088
Explosion	31	94,803
Fire	17	2,935
Grounding	123	230,806
Ramming	46	13,645
Structural Failure	94	330,181
Other	4	54,911
TOTALS	452	951,309 ~~951,317~~

Table 5. Tankship total losses and their influence on oil outflow, 1969-1973, tankships over 3000 deadweight tons

INVOLVEMENT TYPE	NO.	OIL OUTFLOW (Long Tons)	% OF TOTAL OUTFLOW FROM ALL INVOLVEMENTS
Breakdown	2	29,350	3
Collision	7	140,779	15
Explosion	11	88,780	9
Fire	1	1,250	0.1
Grounding	12	134,449	14
Ramming	0	0	0
Structural Failure	15	322,519	34
Other	3	54,790	6
TOTALS	51	771,917	81

NOTE TOTAL OIL OUTFLOW FROM ALL INVOLVEMENTS EQUALS 951,317 LONG TONS (FROM TABLE 4)

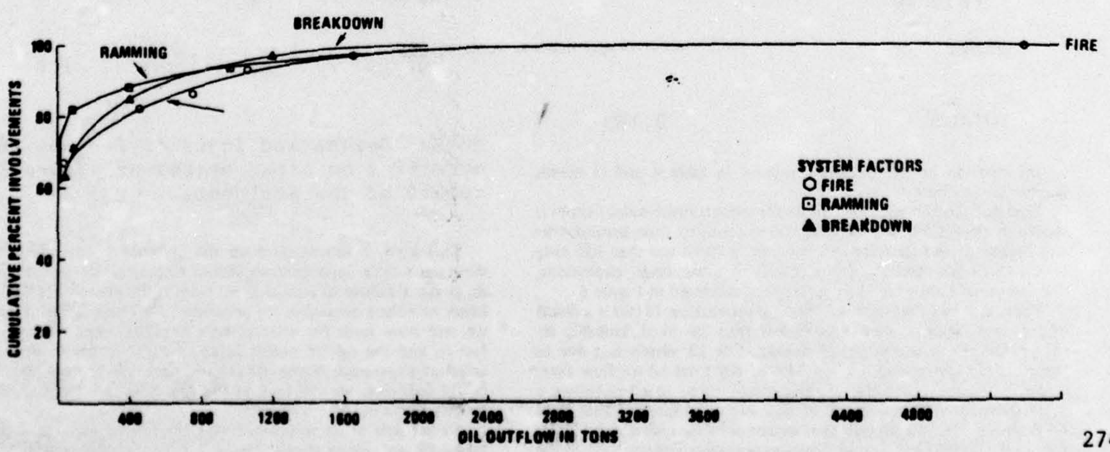


Figure 5. Size distribution of oil outflows for breakdowns, fires, and rammings.

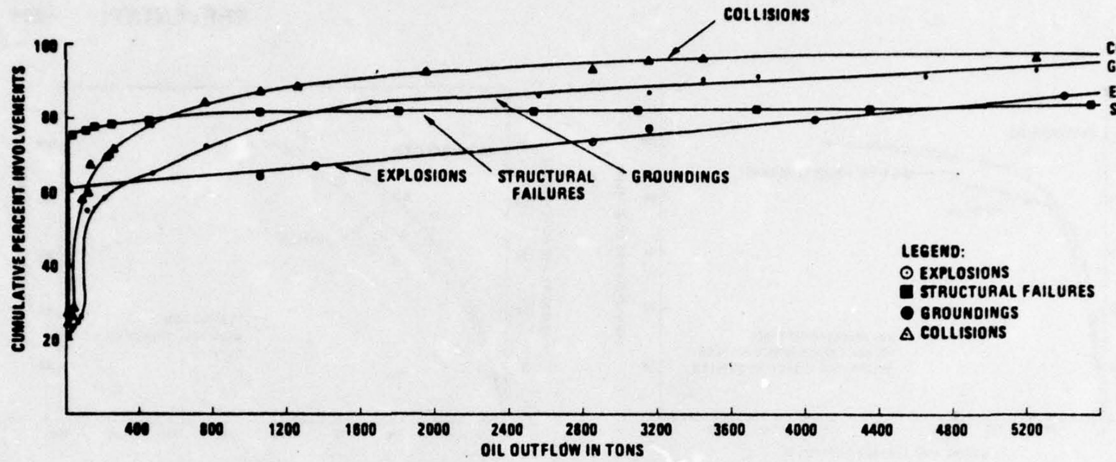


Figure 6. Size distribution of oil outflows for collisions, explosions, groundings, and structural failures.

Table 6. Accident sequence for 47 tankship losses, 1969-1973, tankships over 10,000 deadweight tons

Accident Sequence	Number	Oil Outflow (Long Tons)
Breakdown-Structural Failure-Sink	1	16,350
Breakdown-Grounding-Sink	1	13,000
Collision-Sink	2	4,138
Collision-Explosion/Fire-Sink	4	136,163
Explosion/Fire-Sink	12	90,030
Grounding-Explosion/Fire-Sink	1	2,500
Grounding-Sink	9	134,726
Flooding-Sink	2	54,669
Structural Failure-Grounding-Sink	1	40,000
Structural Failure-Sink	14	282,519
Totals	47	774,095

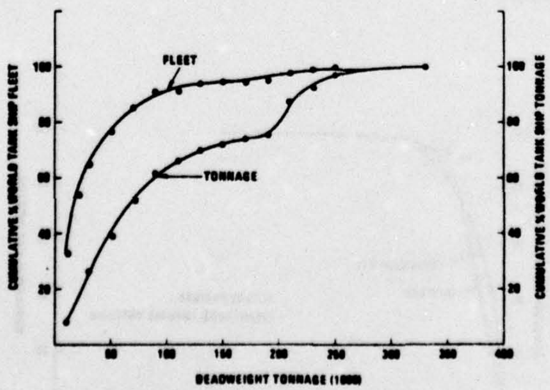


Figure 7. Size distribution of world tankship vessels and tonnage, vessels over 2000 gross tons, 1971.

Table 7. Description of loss of structural integrity for 47 tankship losses, 1969-1973, tankships over 10,000 deadweight tons

Description	Number	Oil Outflow (Long Tons)
A. Loss of structural integrity of hull caused primarily by external forces or where local material conditions deteriorated. No explosion or fire was associated with the accident. These may be broken down into:		
1. Structural failure of main hull girder from excess bending or shear loading	12	243,619
2. Local structural failure of hull envelope		
a. Failure of hull penetration	2	36,750
b. Local hull plating failure	2	39,169
c. Unknown local structure failure	1	34,000
3. Hull damage caused by collision or grounding		
a. Collision	2	4,138
b. Grounding	11	187,726
SUBTOTAL	30	545,402
B. Loss of structural integrity from damage caused primarily by explosion or fire or where explosion or fire contributed to loss of structural integrity. These may be broken down into:		
1. Explosion or fire initiated in own ship cargo tanks	12	90,030
2. Explosion or fire set off by vessel collision or grounding		
a. Collision	4	136,163
b. Grounding	1	2,500
SUBTOTAL	17	228,693

Figures 9 through 15 show the distribution of involvements and resulting outflows for different involvement types.

Vessel age is another factor we might suspect bears some relationship to the occurrence of failure events, and structural failures in particular. During the five-year period, 515 structural failures occurred. Of those, 94 resulted in an estimated 339,181 long tons of oil outflow. Fifteen total losses due to structural failure accounted for 322,519 long tons of outflow (95% of total outflow due to structural failures and 34% of all outflows). Figure 16 shows the distribution of these structural failures with vessel age, and figure 17 shows their distribution by size. Structural failures can result from

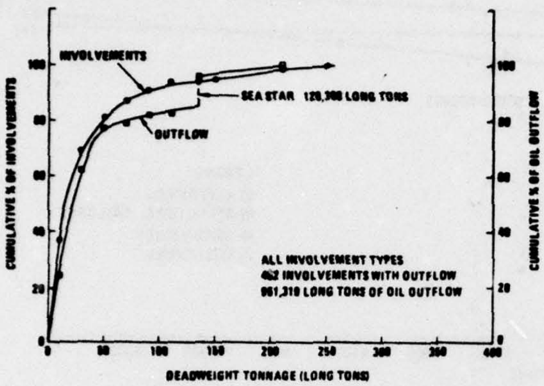


Figure 8. Distribution of 452 involvements with outflow and outflow amounts.

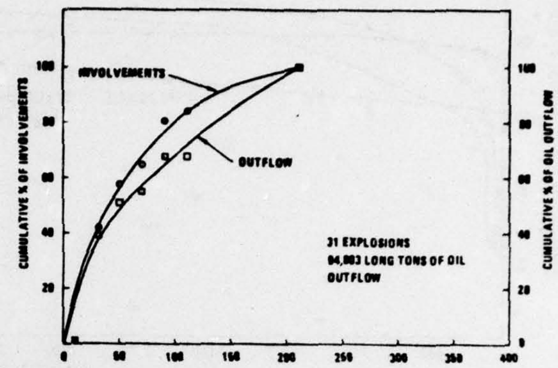


Figure 11. Distribution of 31 explosions with outflow and resulting outflows.

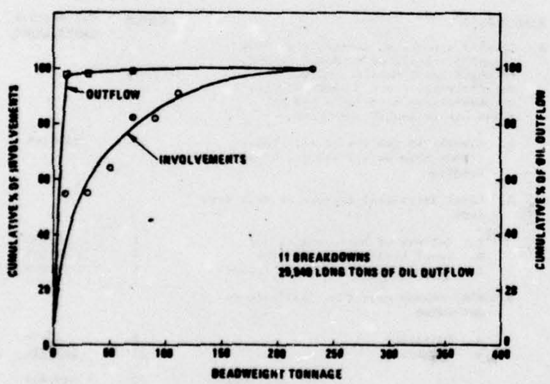


Figure 9. Distribution of 11 breakdowns with outflow and resulting outflows.

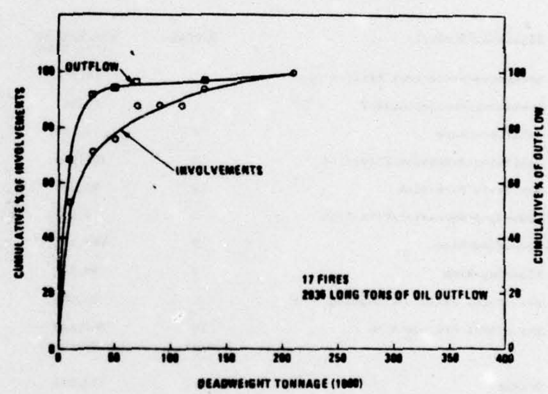


Figure 12. Distribution of 17 fires with outflow and resulting outflows.

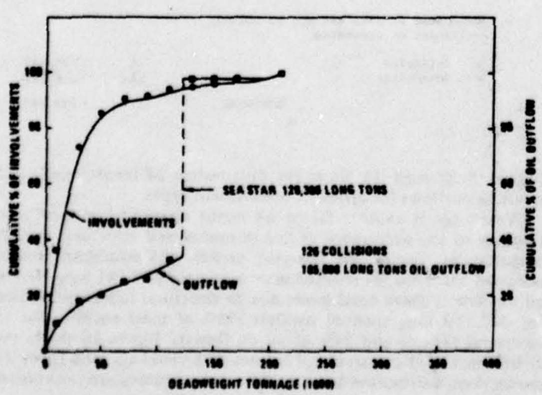


Figure 10. Distribution of 126 collisions with outflow and resulting outflows.

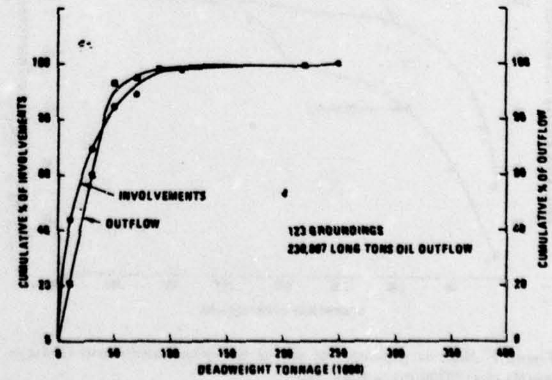


Figure 13. Distribution of 123 groundings with outflow and resulting outflows.

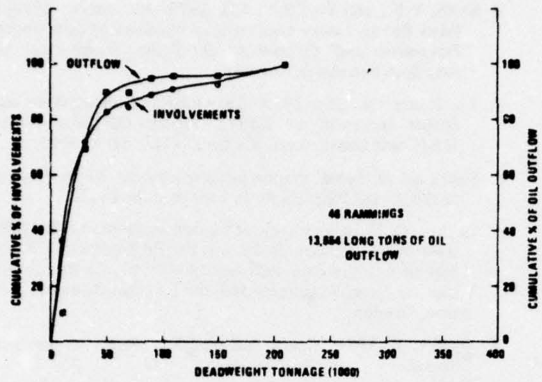


Figure 14. Distribution of 46 rammings with outflow and resulting outflows.

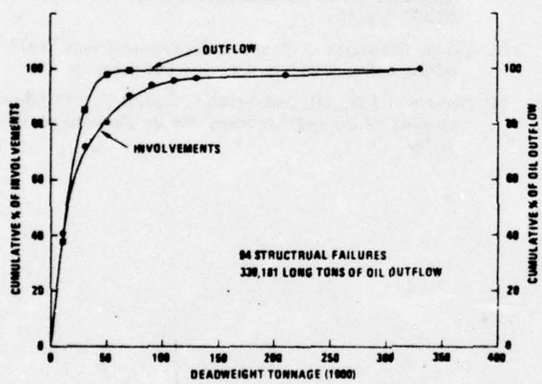


Figure 15. Distribution of 94 structural failures with outflow and resulting outflows.

poor structural design, loads exceeding the design loads due to unusual environmental conditions or improper loading, or deterioration due to corrosion or erosion. Corrosion and erosion depend on time as well as inspection and maintenance, protective coatings, cargo, and environmental conditions. Time may also be required for design defects to make themselves apparent. The sharp increase in structural failures between 15 and 20 years indicates ships in this age group are more subject to loss from this cause. Quaille [7] reports an increase of tanker loss ratio (ratio of tonnage lost to tonnage in the group) for tankers in the 15-19 year and 20-24 year age groups but does not indicate how the vessel losses occurred. At the very best though, age can only be a gross indicator of probability of failure. We must look further into these structural failures to identify factors more directly linked with them.

Table 8 gives a breakdown by location of the 443 tankship involvements with oil outflow where location could be determined. The bulk of collisions with outflow occurred in the coastal, entranceway, and harbor areas, as one would expect. Half of the explosions occur at sea. Over half of the fires with outflow occur at the pier. The majority of groundings occur in coastal or entrance areas, with a smaller contribution coming from harbors. Rammings in the harbor or at a pier are the bulk of ramming involvements. And a majority of structural failures occur at sea. This confirms that pathway plays an important role in collisions and groundings, along with the ship and human factors.

There are a number of other ways the data records could be examined to test for relationships between system factors and

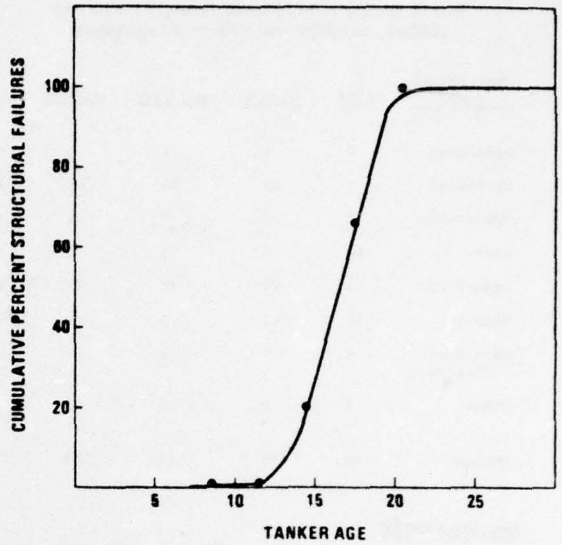


Figure 16. Distribution of 15 tankship total losses due to structural failure by vessel age.

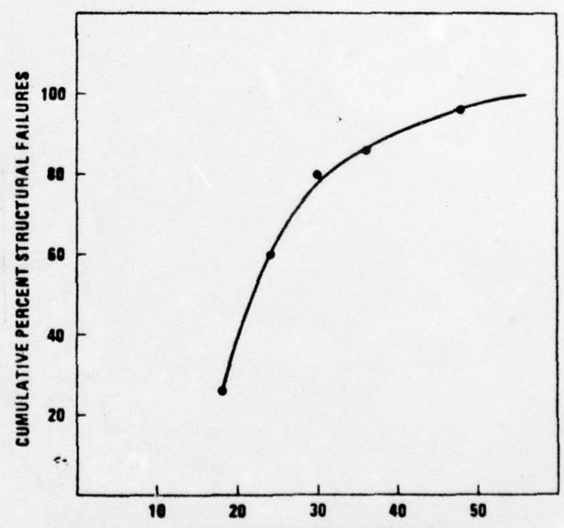


Figure 17. Distribution of 15 tankship total losses due to structural failure by vessel size.

occurrence of failure events. Additional work on several of these is underway.

Application of results

Analysis of the information collected has really just begun. Properly digested, the accident information should be useful in evaluating various alternative measures for reducing accidents and resulting oil outflows, as well as other losses. They may also be of use in evaluating risks associated with future oil transport and production activity decisions.

Table 8. Location of 452 tankship involvements with outflow, tankships over 3000 deadweight tons

INVOLVEMENT TYPE	PIER	HARBOR	ENTRANCE	COASTAL	SEA
Breakdown	0	1	1	5	3
Collision	5	41	25	45	9
Explosion	5	4	0	6	15
Fire	10	2	0	1	4
Grounding	1	27	40	53	0
Ramming	18	15	5	4	2
Structural Failure	8	9	4	7	64
Other	1	0	0	2	1
TOTALS	48	99	75	123	98

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157.09(e) Segregated ballast spaces must be distributed between the cargo tanks and the outer hull or between cargo wing tanks so as to satisfy the criteria of the Appendix C to the regulations in Part 157.

Appendix C

1. Source. The criteria in this appendix constructively interprets the requirements of Regulation 13 of Annex I of the International Convention for the Prevention of Pollution from Ships, 1973 done at London, November 2, 1973.

2. Rationale. The distribution of the segregated ballast capacity required by Regulation 13 of Annex I is not specified by the Convention. Study has shown that such distribution can be beneficial in mitigating the effect of collision or stranding accidents and their effects. Certain general guidelines for segregated ballast location are necessary to encourage superior designs without unduly limiting the flexibility to develop new designs. Certain desirable design configurations meet the formula criteria by virtue of inherent sufficient protected shell area, others by a combination of protected shell area and reduced hypothetical outflows in case of collision or stranding.

3. Formula. For tank vessels of conventional length to beam to depth ratios, calculations demonstrating compliance with this appendix must be submitted to the Coast Guard for review. New tank vessels other than those conventionally configured must demonstrate compliance under Section 157.07 of these regulations:

a. To qualify as protective space, ballast tanks must be -

(1) at least one and one-half meters in breadth, and/or
(2) at least two meters in depth.

b. The protection afforded by segregated ballast tanks must be determined by the following formula:

$$\sum PA_c + PA_s \geq .65 \left(\frac{O_c}{O_A}\right) \left(\frac{1}{t}\right) \quad (2D) + .45 \left(\frac{O_s}{O_A}\right) \left(\frac{1}{t}\right) \quad (B)$$

Where: PA_c and PA_s = The side and bottom areas qualifying as protective spaces within the cargo tank space based upon projected molded dimensions.

PA_c = side shell area where cargo is separated from side shell by a distance of at least 1.5 meters. (This includes both port and starboard sides.)

PA_s = bottom shell area where cargo is separated from bottom shell by a distance of at least two meters.

l_t = the length from the collision bulkhead to the forward bulkhead of the machinery space.

D = molded depth of the vessel

B, O_s, O_c and O_a have the same meaning as used elsewhere in these regulations.

APPENDIX D: Information on U. S. Vessels for Valdez/West Coast Service

(Information from paper "Tanker Supply and Demand for the Alaskan Oil Trade" by J. A. Gribbin, Economist, U. S. Department of Commerce, Maritime Administration, Division of Marine Plans, Office of Policy and Plans)

Tanker Supply and Demand for the Alaskan Oil Trade

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June, 1975

SUMMARY

The Alaska pipeline, which is scheduled to begin operation by mid 1977, is expected to place substantial tonnage requirements ypon the Jones Act tanker fleet. This paper addresses the issue of whether ample tonnage will be available to transport the increased flow of oil from Alaska to the lower 48 states. The highlights of the paper are summarized below:

Increased Alaskan Oil Flows

- Upon opening, the pipeline, together with production from Cook Inlet, is expected to supply 815,000 barrels of crude oil per day. This figure will rise to 2,241,000 barrels per day by 1980.

- A polling of industry and government officials indicates that the distribution of this oil is likely to be divided between Puget Sound, San Francisco, and Long Beach on a 15-40-45 basis until about 1980.

- It is likely that a surplus of petroleum will develop on the West Coast by 1980. Sohio has announced plans to move this anticipated surplus (about 500,000 barrels per day) to the Mid-West via a pipeline from Southern California. This paper evaluates the impact of such a surplus on the supply/demand balance of tanker tonnage and analyzes a "no surplus" case as well.

- The appendix provides a sensitivity analysis which shows the extent to which tonnage requirements are affected by shifting the destination of some oil from Puget Sound and San Francisco to Long Beach. Within the limits of this analysis, increasing the Long Beach share of Alaskan oil does not signficantly alter the demand for tanker tonnage.

Tanker Tonnage Suitable and Eligible for Alaskan Trade

- Ample tanker tonnage exists for the Alaskan trade as well as for other Jones Act requirements if: (1) a 30 year economic life is assumed for eligible tankers; (2) domestic tanker requirements, excluding Alaska, decline by about 400,000 DWT and; (3) MSC requirements remain constant at 852,000 DWT. (See pp. 11-15)

- Based on a an assessment of all Jones Act requirements, 44 vessels totalling 4.9 million DWT were considered both suitable and eligible for the Alaskan trade by

May of 1980. This total includes two Seatrain VLCCs (225,000 DWT each) which must first repay CDS before eligibility for domestic service is granted.

- Excluding the Seatrain VLCCs, aggregate supply is reduced to 42 vessels totalling 4.4 million DWT. (See Table 3, pp. 6-7)

Supply and Demand Balance of Tanker Tonnage for Alaskan Trade

- With the inclusion of the two Seatrain VLCCs, a tanker surplus is expected at all stages of the pipeline's construction. (See Table 4, p. 8)

- If the Seatrain VLCCs are excluded from the list of tankers expected to operate in the Alaskan trade, surplusses will continue at most stages of pipeline's development. The only deficit anticipated under the scenario would occur for a five month period in 1980 if a .5 million barrel per day surplus is realized on the West Coast and if it is transported to the Mid-West through pipelines originating in Southern California. (See Table 5, p. 10)

Tanker Supply and Demand for the Alaskan Oil Trade

The Alaska pipeline, which is scheduled to begin operation in mid 1977, will create a demand for a substantial amount of tanker tonnage. This paper addresses the issue of whether ample tonnage will be available to transport the increased flow of oil from Alaska to the lower 48 states.

The Senate Committee for Interior and Insular Affairs recently published a report entitled "The Trans-Alaska Pipeline and West Coast Petroleum Supply, 1977-1982", but unfortunately, most of the data contained in that study are already obsolete. As a consequence, the Maritime Administration surveyed officials of Alyeska, British Petroleum, Atlantic Richfield, the American Petroleum Institute, the Department of the Interior and the Federal Energy Administration in order to develop reliable current estimates of the timing and phasing of the line, the line's capacity at each stage, and the destination of the throughput. It is generally accepted that the pipeline will begin operation in the third quarter of 1977 (1977.3) and will transport approximately 600,000 barrels per day. By 1978.1 this throughput is expected to rise to about 1.2 million barrels per day and by 1980.1, with the addition of several more pumping stations, the line is expected to carry its full capacity of 2 million barrels per day. It should be noted that known reserves place the optimum rate of oil flow at only 1.8 million barrels per day. Corporate

officials are confident however, that additional sources in the Lisbon and Kuparuk fields can be tapped so that the 2 million barrels a day capacity can be fully utilized. In addition, based on an unpublished study by the Rand Corporation, Cook Inlet is expected to yield about 215,000 barrels a day by 1977.3, 220,000 by 1978.1 and 241,000 by 1980.1. There is also wide agreement regarding the destination of the oil up to 1980. It is believed that up to that point, the throughput will be divided between Puget Sound, San Francisco and Long Beach on about a 15-40-45 basis. When the pipeline reaches its maximum throughput of two million barrels a day in 1980, there may be a surplus of about 500,000 barrels a day on the West Coast. If this surplus develops, it will probably be transshipped to the Midwest through a pipeline originating in Southern California. In order to fully consider this possibility, two cases are postulated for 1980 - (1) a zero surplus case in which the 15-40-45 destination is maintained, (2) a one-half million barrel per day surplus which would be transported to the Midwest totally out of Long Beach (the 15-40-45 pattern is maintained for all but the last one-half million barrels per day). Based on all the information available, case two is the most likely. The destination of the pipeline throughput at various stages of development, including the two cases listed above, is shown in Table 1.

Table 1

Destination of Throughput of Alaskan Oil Pipeline
(thousands of barrels per day)

Port	1977.3	1978.1	1980.1 (No surplus)	1980.1 (.5 MMB/D surplus pipeline from Long Beach)
Puget Sound	122	213	336	261
San Francisco	326	568	896	696
Long Beach	367	639	1,009	1,284
Total = North Slope & Cook Inlet	815	1,420	2,241	2,241

Assuming a sustained sea speed of 15.5 knots, and allowing 1 1/2 days each for loading and discharge, plus 12 hours for voyage delays and 15 days out-of-service time for vessel repairs, a single vessel could complete the following number of voyages per year from Valdez or Cook Inlet to the West Coast.

Port	Round-Trip Distance	Voyage Length	Voyage Per Year
Puget Sound	2,500 Miles	10.2 Days	34.3
San Francisco	3,400 Miles	12.6 Days	27.7
Long Beach	4,100 Miles	14.5 Days	24.1

The size of the ships destined for this trade has been generally planned for the 80,000 to 165,000 DWT range. Using a barrels-to-long ton conversion factor of 7.58 for domestic crude oil, and a representative ship size of 120,000 DWT (115,200 CDWT), the capacity in barrels for

this ship would be 873,216. Drawing upon the material developed in the above tabulation and in Table 1, the approximate total number of vessels required for this trade will be as shown in Table 2.

Table 2
Tanker Demand for Alaskan Oil Trade
120,000 DWT Ships Only
(115,200 CDWT)

Port	1977.3 .815 MMB/D	1978.1 1.420 MMB/D	1980.1 2.241 MMB/D (No surplus)	1980.1 2.241 MMB/D (.5 MMB/D surplus pipeline from Long Beach)
Puget Sound	1.49	2.59	4.10	3.18
San Francisco	4.92	8.57	13.52	10.50
Long Beach	6.37	11.08	17.50	22.27
Total No. of Vessels	12.78	22.24	35.12	35.95
Total DWT (thousand)	1,534	2,669	4,214	4,314

In anticipation of these requirements, a number of vessels in the 60,000 to 129,000 DWT range have already been constructed. As Table 3 illustrates, 26 vessels totalling 2,141,800 DWT which are believed suitable for this trade have been built, although not all are necessarily intended for this service. Moreover, there are 16 additional vessels in the 90,000 - 190,000 DWT range (totalling 2,265,400 DWT) that are currently under construction or on order. Of these 16 vessels, four totalling 416,000 DWT will have been delivered by 1977.3; three more totalling 179,565 DWT by 1978.1, and eight others totalling 1,355,000 DWT before 1980.1 The remaining tanker on order (150,000 DWT) is expected to be delivered by May 1980. Finally, two Seatrain tankers (225,000 DWT each) scheduled for delivery in December of 1975 and December of 1976 respectively, are potentially eligible for service in the Alaskan trade. The eligibility of these VLCCs is contingent on the repayment of construction differential subsidies (CDS).

Table 4 indicates that the application of existing vessels together with these to be delivered as indicated above, produces a tonnage surplus at all stages of the pipeline construction. Upon opening at 600,000 B/D, the surplus amounts to 1,473,800 DWT (equivalent to 12.3 120 MDWT tankers). In 1978.1, when the pipeline achieves 1.2 million barrels daily, the surplus decreased to 683,200 DWT (equivalent to 5.7 120 MDWT tankers). By 1980.1, when the pipeline achieves its capacity flow of 2 million barrels per day, the balance of

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Table 3

U.S. Flag Privately-Owned Tankers
Delivered or on Order for
the Alaskan Oil Trade

Vessel Name or Owner/Builder	Operator	Year Built or Proj. Delivery	DWT
ARCO PRUDHOE BAY	Atlantic Richfield	1971	69,500
ARCO SAG RIVER	Atlantic Richfield	1972	69,500
ARCO ANCHORAGE	Atlantic Richfield	1973	120,000
ARCO FAIRBANKS	Atlantic Richfield	1974	120,000
ARCO JUNEAU	Atlantic Richfield	1974	120,000
CHEVRON MISSISSIPPI	Chevron Oil Co.	1972	70,500
CHEVRON CALIFORNIA	Chevron Oil Co.	1972	70,200
CHEVRON HAWAII	Chevron Oil Co.	1973	69,500
GOLDEN GATE	Keystone Shipping	1970	61,000
EXXON HOUSTON	Exxon Transportation	1964	67,400
EXXON NEW ORLEANS	Exxon Transportation	1965	67,000
EXXON SAN FRANCISCO	Exxon Transportation	1969	75,400
EXXON PHILADELPHIA	Exxon Transportation	1970	75,500
EXXON BATON ROUGE	Exxon Transportation	1970	75,400
OVERSEAS NATALIE	Maritime Overseas Shipping	1961	67,200
OVERSEAS ALASKA	Maritime Overseas Shipping	1970	62,000
OVERSEAS ARTIC	Maritime Overseas Shipping	1971	61,400
OVERSEAS JUNEAU	Maritime Overseas Shipping	1973	120,000
JOSEPH T. POTTS	Mathiasen's Tanker	1970	80,000
SOHIO INTREPID	Mathiasen's Tanker	1971	80,000
SOHIO RESOLUTE	Mathiasen's Tanker	1971	80,000
MOBIL ARTIC	Mobil Oil	1972	125,000
SANSINENA II	Sea Road, Inc.	1971	6[illegible],500
AMERICAN SUN	Sun Oil Co.	1969	80,700
MANHATTAN	Hudson Waterways	1962	114,700
VANTAGE DEFENDER	Vantage Steamship	1959	67,400
Subtotal (existing tonnage)	26 Vessels		2,141,500
SOHIO/SUN SB&DD	Sohio	8/75	118,500
*POLK/SEATRAIN	---	12/75	225,000
SOHIO/SUN SB&DD	Sohio	2/76	118,500
*FILLMORE/SEATRAIN	---	12/76	225,000
SHIPMOR/NASSCO	---	3/77	89,700
SHIPMOR/NASSCO	---	4/77	89,700
Subtotal (available by 1977.3)	32 Vessels		3,007,500

* Eligibility contingent upon repayment of CDS funds.

Vessel Name or Owner/Builder	Operator	Year Built or Proj. Delivery	DWT
SHIPMOR/NASSCO	---	10/77	89,700
SHIPMOR/NASSCO	---	11/77	89,700
SOHIO/AVONDALE	Sohio	11/77	165,000
Subtotal (available by 1978.1)	35 Vessels		3,352,200
SHELL/NASSCO	Shell Oil	1/78	190,000
SOHIO/AVONDALE	Sohio	5/78	165,000
SHELL/NASSCO	Shell Oil	7/78	190,000
SOHIO	Sohio	9/78	165,000
SOHIO/AVONDALE	Sohio	1/79	165,000
SOHIO/AVONDALE	Sohio	5/79	165,000
SOHIO/AVONDALE	Sohio	9/79	165,000
ARCO/NASSCO	Atlantic Richfield	10/79	150,000
Subtotal (available by 1980.1)	43 Vessels		4,707,200
ARCO/NASSCO	Atlantic Richfield	5/80	150,000
Total (available in 1980.2)	44 Vessels		4,857,200

tonnage will range from a surplus of 393,200 DWT to 493,200 DWT (equivalent to 3.3 to 4.1 120 MDWT tankers) depending on whether or not the West Coast experiences a petroleum surplus. Finally, by May 1980, when delivery is taken on the final 150,000 DWT tanker, the surplus will fall to 543,200 DWT and 643,200 DWT (equivalent to 4.5 to 5.4 120 MDWT tankers) depending on the scenario realized.

Table 4

Supply and Demand Balance for Tanker Tonnage in the Alaskan Oil Trade*
(thousands of DWT)

	1977.3 .815 MB/D	1978.1 1.420 MB/D	1980.1 2.241 MB/D (No surplus)	1980.1 2.241 MB/D (.5 MMB/D surplus pipeline from Long Beach)
Tonnage Required	1,534	2,669	4,214	4,314
Suitable Existing Tonnage Per Time Period	3,007.8	3,352.2	4,707.2	4,707.2
Surplus	+1,473.8	+ 683.2	+ 493.2	+ 393.2
Tonnage of Additional Tanker to be Delivered in 1980.2			150.0	150.0
Surplus			+643.2	+543.2

* The supply of tanker tonnage includes two Seatrain VLCCs. Estimates of delivered petroleum include Cook Inlet production.

Table 4 is based on the assumption that all tankers which are both suitable and eligible for the Alaskan trade participate. Recent developments on the West Coast however, have cast doubts on whether the two 225,000 DWT tankers being built at Seatrain will be considered suitable for that trade. On May 30, 1975, the Governor of the State of Washington signed into law a bill which places severe limits and controls on tanker traffic in Puget Sound. Among these limitations is a provision stating that any oil tanker, whether enrolled or registered, of greater than 125,000 DWT shall be prohibited from proceeding beyond a point east of a line extending from Discovery Island light South to New Dungeness light. In addition, the California Coastal Zone Conservation Commission, in its Preliminary Coastal Plan, March 1975, indicates that:

> No existing California tanker terminal can accommodate conventional tankers larger than 138,000 DWT (Port of Long Beach), although with only minor dredging and expansion of onshore pipeline and storage tank facilities, this limit could be increased to about 150,000 DWT for ships of conventional draft. With some modifications to existing facilities the Port of Long Beach could berth three tankers of up to 200,000 DWT of the wide beam configuration now being proposed; or tankers up to 138,000 DWT of conventional draft. (Page 230 of **Preliminary Coastal Plan**)

Unfortunately, the Seatrain tankers have deeper than conventional drafts due to their narrow hulls.

If the Seatrain tankers are not accommodated on the West Coast, the supply of tanker tonnage for the Alaskan trade will be reduced by 450,000 DWT for all stages of the pipeline development. A revised projection which takes this reduction into account is shown in Table 5.

Table 5

Supply and Demand Balance for Tanker Tonnage in the Alaskan Oil Trade*
(thousands of DWT)

	1977.3 .815 MB/D	1978.1 1.420 MB/D	1980.1 2.241 MB/D (No surplus)	1980.1 2.241 MB/D (.5 MMB/D surplus pipeline from Long Beach)
Tonnage Required	1,534	2,669	4,214	4,314
Suitable Existing Tonnage Per Time Period	2,557.8	2,902.2	4,257.2	4,257.2
Surplus or Deficit	+1,023.8	+ 233.2	+ 43.2	- 56.8
Tonnage of Additional Tankers to be delivered in 1980.2			150.0	150.0
Surplus			+193.2	+ 93.2

* Excludes two 225,000 DWT tankers being constructed at Seatrain. Estimates of delivered petroleum include Cook Inlet production.

Table 5 indicates that a tonnage surplus will continue to exist at all but one stage of the pipeline construction. In the first stage of development, the Alaskan trade will have a 1,023,800 DWT tanker surplus (equivalent to 8.5 120 MDWT tankers). This excess will fall to 233.2

MDWT (equivalent to 1.9 120,000 DWT tankers) by 1978.1. By 1980.1 the balance of tonnage will range from a 56.8 MDWT deficit to a 43.2 MDWT surplus (between -.47 and +.36 120,000 DWT equivalents) depending whether or not there is a surplus of petroleum on the West Coast at that time. Once the final tanker, a 150,000 DWT vessel to be constructed for Arco at NASSCO, is delivered in May of 1980, a surplus is expected to exist regardless of whether or not a petroleum surplus exists on the West Coast. This surplus of tonnage is expected to range between 93.2 MDWT and 193.2 MDWT (equivalent of .78 and 1.61 120,000 DWT vessels).

It should be reemphasized that the projections in this paper are based on the supply of tonnage shown in Table 3. It is appropriate, therefore, to justify the "assignment" of these tankers to the Alaskan trade. This assignment was based on the following considerations. First, it is generally agreed that of the vessels listed, those yet to be delivered are intended for service in the Alaskan trade (with the possible exception of the Seatrain tankers). With respect to the existing tankers, Table 6 shows the actual employment of these vessels as of December 31, 1972 and December 31, 1973. Although thirteen of these 26 ships were not employed in the domestic trade in either of the two years, the depressed condition of the world tanker market is likely to force these 13 vessels to seek employment in the Alaskan trade. Five of the remaining vessels belong to Exxon which has indicated to MarAd that these vessels, presently employed in the Gulf - East Coast trade, are expected

Table 6

Employment Status of U.S.-Flag
Tankers Eligible for Alaskan Trade
(Between 60,000 and 120,000 DWT)

Name	MDWT	Employment[1/] 12/31/72	12/31/73
ARCO PRUDHOE BAY	69.8	63	61
ARCO SAG RIVER	69.8	23	61
ARCO ANCHORAGE	120.0	—	17
ARCO FAIRBANKS	120.0	—	—
CHEVRON HAWAII	70.5	—	64
CHEVRON MISSISSIPPI	70.5	63	64
CHEVRON CALIFORNIA	70.2	63	63
GOLDEN GATE	61.0	63	10
EXXON SAN FRANCISCO	75.6	60	60
EXXON PHILADELPHIA	75.6	60	12
EXXON BATON ROUGE	75.6	60	60
OVERSEAS ALASKA	62.0	1N	17
OVERSEAS ARTIC	61.4	43	14
OVERSEAS JUNEAU	120.0	—	1N
JOSEPH D. POTTS	80.0	63	04
SOHIO INTREPID	80.0	1N	13
SOHIO RESOLUTE	80.0	22	13
MOBIL ARCTIC	125.0	17	1N
SANSINEA II	69.8	63	63
AMERICA SUN	80.7	14	31
EXXON HOUSTON	67.9	60	60
EXXON NEW ORLEANS	67.8	60	60
MANHATTAN	114.7	47	10
OVERSEAS NATALIE	67.2	43	13
VANTAGE DEFENDER	67.4	12	14
ARCO JUNEAU	120.0	—	—

1/ Employment Code

1N	Transatlantic - India - Persian Gulf
04	W. Indies, Bermuda, N Coast of South America
10	Transatlanta - Atlantic, Europe and United Kingdom
12	" - Mediterranean and Black Sea
13	" - East and South Africa
14	" - West Africa
17	" - Persian Gulf
22	Transpacific - India (Via Orient)
23	" - Atlantic, Pacific Straits-Orient
31	West Coast South America
43	Foreign to Foreign - Persian Gulf - Mediterranean
47	" " " (Other)
60	Domestic - Atlantic/Gulf Coast
61	" - Pacific Coast
63	" - Alaska
64	" - Hawaii

to become surplus in about 1977 due to the expected increase in the capacity of the Colonial Pipeline. Exxon intends to place all five of these tankers in the Alaskan trade. It is clear that the deployment of these 18 tankers to the Alaskan trade would not create supply gaps in alternate domestic trades. Of the remaining tankers, six are already engaged in domestic Pacific and Alaskan treades. The final two vessels which are owned by Chevron and are presently operated in the Hawaiian domestic service, have also been earmarked for the carriage of North Slope oil.

The reassignment of these last eight vessels (561,600 DWT) are the only instances where supply shortages might be created. As much as 140,000 DWT of the potential shortage will be offset by the increased flow of oil from Alaska which should reduce the present need for intra-area shipments on the West Coast. Ample tonnage will be available to fill these potential deficits, however. This conclusion is based on an evaluation of the supply and demand balance of tanker tonnage for the entire Jones Act Trade. If a 30 year life is assumed, the tonnage available for Jones Act Trades in 1981 totals 9,335,300 DWT (excludes two Seatrain VLCCs). The use of the 30 year life assumption is based on Maritime Administration data which show that since 1973, the average age of scrapped vessels eligible for the domestic trade has been about 29.3 years. Moreover, as of February 1975, there were 41 tankers totalling 875,100 DWT, (20% of the domestic tanker fleet) eligible for domestic service which were over 30 years of age. While this number

includes 30 vessels which have been converted, these 30 tankers average 12.4 years past their conversion dates and 31.7 years since their original construction. The use of an assumed economic life of 30 years is therefore, probably realistic.

It is not likely that basic demands for the domestic trades (excluding Alaska) will remain at the level of the most recent twelve month period for which MarAd's records are complete — 4,564,000 DWT. Exxon, as mentioned above, has indicated that further developments of the Colonial Pipeline in 1977 will create a surplus for that corporation alone of 414,600 DWT. This total includes the five tankers larger than 60,000 DWT as well as the Exxon Boston, a 52,000 DWT tanker. Accounting for this reduction, 4,149,400 DWT would be required to accommodate domestic carriage requirements. MSC requirements may well decline because of the recent developments in South-East Asia. If however, MSC requirements are assumed to remain constant at 852,000 DWT, this would leave 4,333,900 DWT (assumes a 30 year life) with which to meet the demand for the movement of Alaskan oil (excludes two Seatrain VLCCs). This available tonnage is 19,900 DWT greater than the maximum tonnage requirement for the Alaskan trade as shown in Table 4 and 5. The magnitude of this surplus coupled with the addition of the two Seatrain VLCCs, will certainly be large enough to fill any needs for PL 480 shipments which may arise.

On the other hand, a replacement program for tankers over 25 years of age cannot be discounted as a possibility. Such a replacement program would clearly yield an additional building requirement. Furthermore, despite the expected increase in the capacity of the Colonial Pipeline, there are some indications that refinery construction now under way may lead to new patterns of oil distribution that could actually increase Gulf-to-East Coast tanker requirements. The Office of Policy and Plans is not yet in a position to make firm forecasts in this area, but the matter is presently under study.

Appendix

Although a concensus does exist concerning the pattern of distribution of Alaskan oil to the West Coast, there is not universal agreement on this issue. In light of this, a sensitivity analysis was performed in order to view the balance of tonnage as the share of oil which Long Beach receives, increases. In addition to the split utilized in the text, two additional cases are illustrated. They are:

Distribution of Alaskan Oil

	Text	Case A	Case B
Puget Sound	15%	12.5%	10%
San Francisco	40%	32.5%	25%
Long Beach	45%	55%	65%

The enumeration of tables in Case A and B correspond to those tables which parallel them in the text.

CASE A

Distribution of Alaskan Oil

Puget Sound	12.5%
San Franciso	32.5%
Long Beach	55%

Table 1

Destination of Throughput of Alaska's Oil Pipeline
(thousands of barrels per day)

Port	1977.3	1978.1	1980.1 (no surplus)	1980.1 (.5 MMB/D surplus pipeline from Long Beach)
Puget Sound	102	178	280	218
San Francisco	265	462	728	566
Long Beach	448	781	1,233	1,457
Total	815	1,420	2,241	2,241

Table 2

Tanker Requirements for Alaskan Oil Trade
120,000 DWT Ships Only
(115,200 CDWT)

Port	1973.3 .815 MMB/D	1978.1 1.420 MMB/D	1980.1 2.241 MMB/D (no surplus)	1980.1 2.241 MMB/D (.5 MMB/D surplus pipeline from Long Beach)
Puget Sound	1.24	2.17	3.41	2.66
San Francisco	4.00	6.97	10.99	8.54
Long Beach	7.77	13.55	21.39	25.27
Total No. of Vessels	13.01	22.69	35.79	36.47
Total DWT (thousand)	1,561	2,722	4,294	4,376

Table 4

Supply and Demand Balance for Tanker Tonnage in the Alaskan Oil Trade*

(thousands of DWT)

	1977.3 .815 MMB/D	1978.1 1.240 MMB/D	1980.1 2.241 MMB/D (No surplus)	1980.1 2.241 MMB/D (.5 MMB/D surplus pipeline from Long Beach)
Tonnage Required	1,561	2,722	4,294	4,376
Suitable Tonnage Per Time Period	3,007.8	3,352.2	4,707.2	4,707.2
Surplus	+1,446.8	+ 630.2	+ 413.2	+ 331.2
Tonnage of Additional Tanker to be Delivered in 1980.2			150.0	150.0
Surplus			+563.2	+481.2

* The supply of tonnage includes the two Seatrain VLCCs. Estimates of delivered petroleum include Cook Inlet production.

Table 5

Supply and Demand Balance for Tanker Tonnage in the Alaskan Oil Trade*

(thousands of DWT)

	1977.3 815 MB/D	1978.1 1,240 MB/D	1980.1 2,241 MB/D (No surplus)	1980.1 2,241 MB/D (.5 MMB/D surplus pipeline from Long Beach)
Tonnage Required	1,561	2,722	4,294	4,376
Suitable Existing Tonnage Per Time Period	2,557.8	2,902.2	4,257.2	4,257.2
Surplus or Deficit	+ 996.8	+ 180.2	- 36.8	- 118.8
Tonnage of Additional Tankers to be Delivered in 1980.2			150.0	150.0
Surplus			+113.2	+ 31.2

* The supply of tonnage excludes the two Seatrain VLCCs. Estimates of delivered petroleum include Cook Inlet production.

Case B

Distribution of Alaskan Oil

Puget Sound	10%
San Francisco	25%
Long Beach	65%

Table 1
Destination of Throughput of Alaska's Oil Pipeline
(thousands of barrels per day)

Port	1977.3	1978.1	1980.1 (No surplus)	1980.1 (.5 MMB/D surplus Pipeline from Long Beach)
Puget Sound	81	142	224	174
San Francisco	204	355	560	435
Long Beach	530	923	1,457	1,632
Total	815	1,420	2,241	2,241

Table 2

Tanker Requirements for Alaskan Oil Trade
120,000 DWT Ships Only
(115,200 CDWT)

Port	1977.3 .[illegible] MMB/D	1978.1 1.420 MMB/D	1980.1 2.241 MMB/D (No surplus)	1980.1 2.241 MMB/D (.5 MMB/D surplus pipeline from Long Beach)
Puget Sound	.99	1.73	2.73	2.12
San Francisco	3.08	5.36	8.45	6.56
Long Beach	[illegible].19	16.01	25.27	28.31
Total No. of Vessels	[illegible]	23.10	36.45	36.99
Total DWT (thousand)	[illegible],591	2,772	[illegible],374	[illegible],438

Table 4

Supply and Demand Balance for Tanker Tonnage in the Alaskan Oil Trade*
(thousands of DWT)

	1977.3 815 MB/D	1978.1 1,240 MB/D	1980.1 2,241 MB/D (No surplus)	1980.1 2,241 MB/D (.5 MMB/D surplus pipeline from Long Beach
Tonnage Required	1,591	2,772	4,374	4,438
Suitable Existing Tonnage Per Time Period	3,007.8	3,352.2	4,707.2	4,707.2
Surplus	+1,416.8	+ 580.2	+ 333.2	+ 269.2
Tonnage of Additional Tanker to be Delivered in 1980.2			150.0	150.0
Surplus or Deficit			+483.2	+419.2

* The supply of tonnage includes the two Seatrain VLCCs. Estimates of delivered petroleum include Cook Inlet production.

Table 5

Supply and Demand Balance for Tanker Tonnage in the Alaskan Oil Trade*
(thousands of DWT)

	1977.3 815 MB/D	1978.1 1,240 MB/D	1980.1 2,241 MB/D (No surplus)	1980.1 2,241 MB/D (.5 MMB/D surplus pipeline from Long Beach)
Tonnage Required	1,591	2,772	4,374	4,438
Suitable Existing Tonnage Per Time Period	2,557.8	2,902.2	4,257.2	4,257.2
Surplus or Deficit	+ 966.8	+ 130.2	- 116.8	- 180.8
Tonnage of Additional Tanker to be Delivered in 1980.2			150.0	150.0
Surplus			+ 33.2	- 30.8

* The supply of tonnage exlcudes the two Seatrain VLCCs. Estimates of delivered petroleum include Cook Inlet production.

APPENDIX E: Assumptions and Calculations Used to Develop Table 4, Page 36, on Estimated Oil Inputs to the Oceans From Tankers

APPENDIX E

Assumptions and Calculations Used to Develop Table 4 - Estimated Oil Inputs to the Oceans from Tankers

A. Worldwide Operational Outflows

1. Tank cleaning and ballasting

a. Crude oil carried worldwide by tankers presently using LOT

Assume: (1) 1400 X 10^6 metric tons of crude oil were moved by tanker
(2) 80% of tankers use LOT (20% do not)
(3) LOT is 90% effective (10% ineffective)
(4) The clingage is 0.4% of cargo capacity
(5) 1/3 of tanks are cleaned and/or ballasted during each trip, 1/5 of tanks are ballasted prior to departure from unloading port (dirty ballast)
(6) 15% of the clingage is taken out of the tanks upon pumping out oily ballast

Quantity of cargo moved is from British Petroleum, 1974, other values are discussed by Holdsworth (1971), Porricelli, Keith and Storch (1971), Victory (1973), and are similar to those used in the Maritime Administration Tanker Construction Program EIS (page IV-22).

Using these assumptions, the oil released to the sea is:

amount from tank washings + amount from dirty ballast

$$(1400)(10^6)(.8)(.1)(.004)(.33) + (1400)(10^6)(.8)\ (.004)(.15)(.2)$$

$$147{,}840 + 134{,}400 = 282{,}240$$

A portion of the tank washing is done for clean ballast and a portion for sediment control and routine maintenance. Assume that half of the tank cleaning is for ballast and half for sediment control. (This is the same as saying that if there was no need to clean tanks for clean ballast, 1/6 of the tanks would still be cleaned each voyage for sediment control.) Then the amounts discharged are:

$$147{,}840(.5) + 134{,}400 = 208{,}320 \text{ for clean ballast}$$

$$\text{and } 147{,}840(.5) = 73{,}920 \text{ for sediment control}$$

b. Crude oil carried worldwide by tankers not presently using LOT

Using same assumptions as above:

$$(1400)(10^6)(.2)(.004)(.33) + (1400)(10^6)(.2)(.004)(.15)(.2)$$
$$369{,}600 + 33{,}600 = 403{,}200$$

Again, assume that half the tank cleaning is for clean ballast and half for sediment control. Then, the amounts discharged are:

$$369{,}600(.5) + 33{,}600 = 218{,}400 \text{ tons for clean ballast}$$

$$369{,}600(.5) = 184{,}800 \text{ tons for sediment control}$$

So, for clean ballast	LOT	208,320
	non-LOT	+ 218,400
	Total	426,720

and sediment control	LOT	73,920
	non-LOT	+ 184,800
	Total	258,720

c. Refined products carried, worldwide
Assume: (1) 300×10^6 metric tons of product transported by tanker
(2) Clingage of 0.075% of cargo capacity
(3) 80% of tanks are cleaned each trip
(4) 90% of tank washings are dumped at sea and 10% are discharged to shore reception facilities

Using these assumptions, oil released to the sea is:

$$(300)(10^6)(0.00075)(.8)(.9) = 162{,}000 \text{ tons}$$

d. Tank cleaning prior to entering shipyard
Estimates taken from NAS report, assuming
(1) Complete cleaning every 18 months
(2) Clingage of 0.4%
(3) 50% of washings discharged to sea
(4) Total world tanker fleet of 180 million tons

$$(180)(10^6)(.50)(.004)(.67) = 240{,}120 \text{ tons}$$

2. Tanker bilges and bunkering

Based on the NAS report, 0.6 mta

3. Terminal operations

Use the NAS report figure of 0.003 mta

B. Operational Outflows from U. S. Vessels

1. Tank cleaning and ballasting - These figures are based on the amounts entering U. S. ports from U. S. and foreign sources listed in Table 3. U. S. tankers operating between foreign ports are not included.

   a. Crude oil and residual oil transported by U. S. ships in foreign trade

      Assume: (1) 10 million tons of crude oil and residual oil
      (2) 80% of U. S. tankers use LOT
      (3) LOT is 90% effective (10% ineffective)
      (4) 0.4% clingage
      (5) 1/3 tanks cleaned and/or ballasted each trip, 1/5 of tanks used for dirty ballast
      (6) 15% of clingage is taken out of tanks upon pumping out oily ballast

      for LOT operations:

      $$(10^7)(.8)(.1)(.004)(.33) + (10^7)(.8)(.004)(.15)(.2)$$
      $$1{,}056 + 960 = 2{,}016 \text{ tons}$$

      for non-LOT vessels:

      $$(10^7)(.2)(.004)(.33) + (10^7)(.2)(.004)(.15)(.2)$$
      $$2{,}640 + 240 = 2{,}880 \text{ tons}$$

      making same assumption as before about portion of tank cleaning done for clean ballast and portion for sediment control,

      for clean ballast, $.5(1{,}056 + 2{,}640) + (960 + 240) = 3{,}048$ tons

      and for sediment control, $.5(1{,}056 + 2{,}640) = 1{,}848$ tons

   b. Crude oil and residual oil carried by U. S. ships in domestic trade

      Assume: (1) 62 million tons of crude and residual oil moved in domestic trade
      (2) Only 2/3 of vessels can use LOT (smaller vessels, shorter runs)
      (3) LOT is 90% effective
      (4) 0.4% clingage
      (5) 1/3 of tanks cleaned, 1/5 ballasted with dirty ballast
      (6) 15% of clingage discharged with dirty ballast

      for LOT operations:

      $$(62)(10^6)(.67)(.1)(.004)(.33) + (62)(10^6)(.67)(.004)(.15)(.2)$$
      $$5{,}480 + 4{,}980 = 10{,}460$$

for non-LOT vessels:

$$(62)(10^6)(.33)(.004)(.33) + (62)(10^6)(.33)(.004)(.15)(.2)$$
$$27{,}000 + 2{,}460 = 29{,}460$$

following previous assumption,

for clean ballast, $.5(5{,}480 + 27{,}000) + 4{,}980 + 2{,}460 = 23{,}680$

for sediment control, $.5(5{,}480 + 27{,}000) = 16{,}200$

c. Refined products, U. S. ships, foreign trade
Assume: (1) 10^6 million tons (Table 4)
(2) Other assumptions as in A.l.c. above

then, oil released to sea is:

$$(10^6)(.00075)(.8)(.9) = 540 \text{ tons}$$

d. Refined products, U. S. ships, domestic trade
Assume: (1) 79×10^6 tons
(2) Other assumptions as above

oil to the sea is:

$$(79)(10^6)(.00075)(.8)(.9) = 42{,}700 \text{ tons}$$

Here we have assumed that U. S. barges do not ballast cargo tanks or clean cargo tanks at sea and, therefore, do not release any oil to the sea.

e. Tank cleaning prior to entering shipyard - U. S. ships
Assume: (1) Complete cleaning every two years
(2) .4% clingage
(3) 50% of washings discharged to sea
(4) U. S. fleet of 9×10^6 deadweight tons

then, amount enter water:

$$(.5)(.004)(.5)(9)(10^6) = 9{,}000 \text{ tons}$$

Assume that 80% of this comes from ships in domestic trade and 20% from ships in foreign trade.

2. U. S. tanker bilges and bunkering

Use the NAS figure of approximately 10 tons per ship per year and approximately 290 U. S. tankships.

$$(10)(290) = 2{,}900$$

Again, assume 80% of this is from ships in domestic trade and 20% from ships in foreign trade.

3. Terminal operations

Using the NAS study figures for Milford Haven (0.00011% of throughput is spilled) and applying it to cargo movements in Table 5 (U. S. ships and barges), and assuming cargo is moved twice (loaded and unloaded):

domestic trade $(1.1)(10^{-6})(167)(10^{6})(2) = 370$

foreign trade $(1.1)(10^{-6})(11)(10^{6})(2) = 24$

C. Operational Outflows in U. S. Waters

1. Tank cleaning and ballasting - Take "U. S. waters" to include areas within 50 miles of U. S. coastline.

a. Crude oil and residual oil
Assume: (1) 196 X 10^6 metric tons of crude oil and residual oil transported to this country from foreign sources (Table 4)
(2) 40% (in 1973) of this amount, or 79 X 10^6 tons, came from Venezuela and South America
(3) 20% of the tank cleaning and sediment accumulated on U. S. to Caribbean routes is deposited in U. S. waters
(4) Assume inputs from all U. S. domestic trade ends up in U. S. waters
(5) 80% of crude and residual carriers use LOT, other assumptions as before in B.1.a.

for U. S. - Caribbean trade:

LOT:

$$(79)(10^6)(.2)(.8)(.1)(.004)(.33) + (79)(10^6)(.2)(.8)(.004)(.15)(.2)$$
$$1{,}700 + 1{,}500 = 3{,}200 \text{ tons}$$

non-LOT:

$$(79)(10^6)(.2)(.2)(.004)(.33) + (79)(10^6)(.2)(.2)(.004)(.15)(.2)$$
$$4{,}200 + 380 = 4{,}580 \text{ tons}$$

Making same assumption as before about portion of tank cleaning done for clean ballast and portion for sediment control:

for clean ballast, $.5(1{,}700 + 4{,}200) + 1{,}500 + 380 = 4{,}830$

for sediment control, $.5(1{,}700 + 4{,}200) = 2{,}950$

These are to be added to values for U. S. vessels in domestic trade.

b. For refined products

Assume: (1) 24 X 10^6 tons brought in from foreign sources, 40% from Caribbean (approximately 10 X 10^6 tons)

(2) 20% of tank washings deposited in U. S. waters

(3) Inputs from all U. S. domestic trade ends up in U. S. waters

(4) Other assumptions as in A.1.c.

Then, input from foreign trade is:

$$(10^7)(.2)(.00075)(.8)(.9) = 1{,}080 \text{ tons}$$

Add this to input from domestic trade.

c. Tank cleaning prior to shipyard - assume all U. S. ships go to U. S. yards and tank washings end up in U. S. waters.

2. Tanker bilges and bunkering in U. S. waters. Assume amount is approximately equal to amount of input from all U. S. ships.

3. Terminal operations

Apply NAS figures to amounts in Table 3, remembering part of oil is handled twice at U. S. terminals and part only once.

$$(1.1)(10^{-6})(186+10+23+1)(10^6) + (1.1)(10^6)(62+7+79+19)(10^6)(2)$$
$$242 + 370 = 612$$

APPENDIX F: Calculations for Table 6, page 46, Comparison of Oil Inputs from Tank Cleaning and Ballasting--U. S. Tankships in Domestic TRade

APPENDIX F

Calculations for Table 6 -
Comparison of Oil Inputs from Tank Cleaning and Ballasting -
U. S. Tankships in Domestic Trade

Present oil inputs are estimated in Appendix D and Table 4.

Using B.1.b, d, and e as a guide, calculate inputs from U. S. ships if maximum 1/15,000 of cargo is discharged to the oceans.

a. Crude oil and residual oil carried by U. S. ships in domestic trade
   Assume: (1) 62 million tons of crude and residual oil moved in domestic trade
   (2) All vessels use improved LOT techniques, discharging 1/15,000 of cargo transported

   Amount entering oceans from ships =

   $$(62)(10^6)(1/15,000) = 4,133 \text{ tons}$$

b. Refined products, U. S. ships, domestic trade
   Assume: (1) 79 X 10^6 tons
   (2) All vessels use improved LOT techniques, discharging 1/15,000 of cargo transported

   Amount entering oceans from ships =

   $$(79)(10^6)(1/15,000) = 5,270 \text{ tons}$$

c. Tank cleaning prior to entering shipyard, U. S. ships
   Assume: (1) Complete cleaning every two years
   (2) U. S. fleet of 9 X 10^6 DWT
   (3) Equivalent of 1/15,000 of DWT discharged to the sea

   Amount entering oceans from ships =

   $$(.5)(9)(10^6)(1/15,000) = 300 \text{ tons}$$